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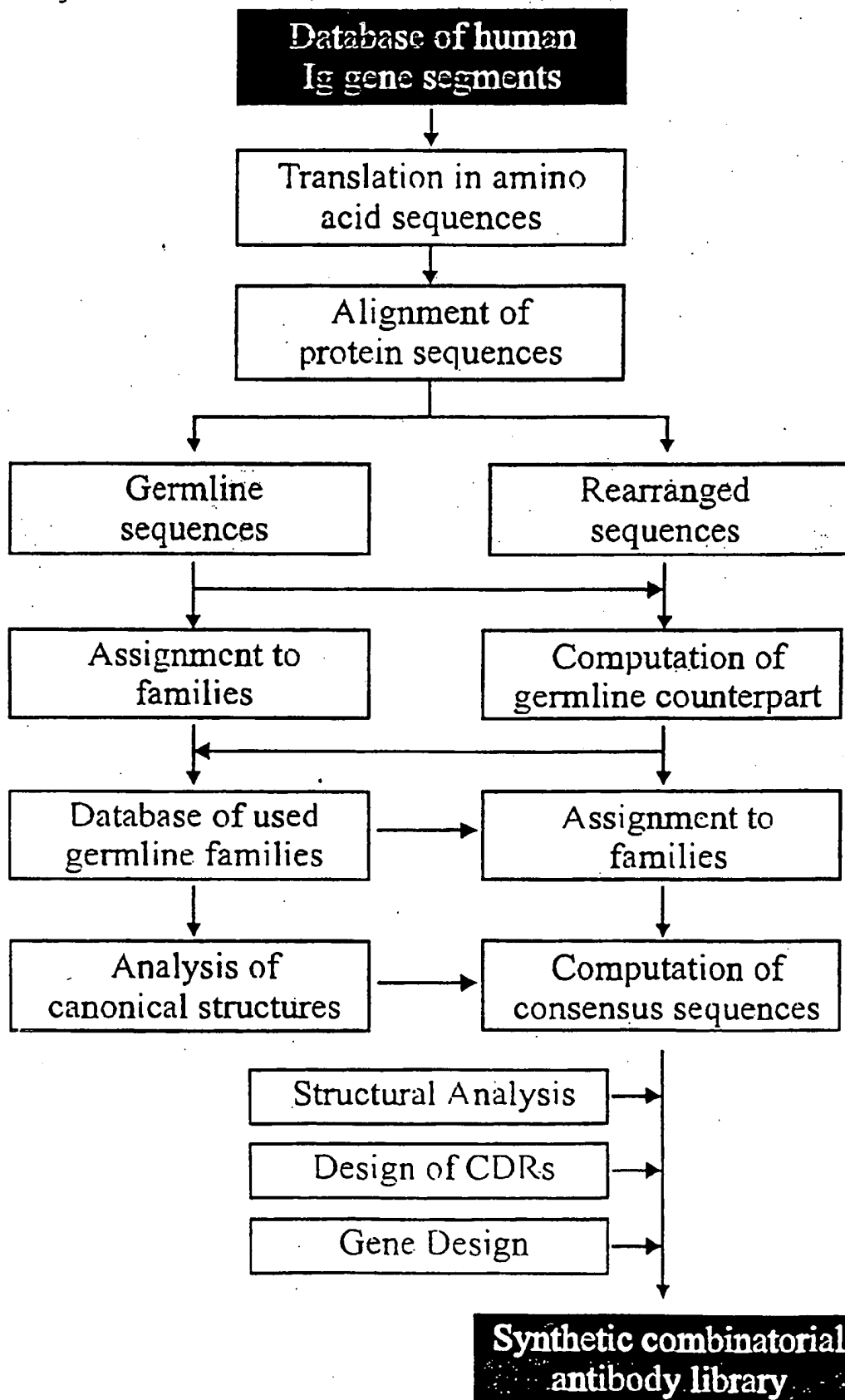
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Figure 1: construction of a synthetic human antibody library based on consensus sequences



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Figure 2A: VL kappa consensus sequences

CDRII		framework 3																												
Vκ1	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Vκ2	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Vκ3	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Vκ4	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84

framework 3		CDRIII										framework 4																	
Vκ1	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109				
Vκ2	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109				
Vκ3	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109				
Vκ4	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109				

2

SUBSTITUTE SHEET (RULE 26)

4 / 204

Figure 2B: VL lambda consensus sequences

framework 3	
VA1	V P D R F S G S K S G T S A S L A I T G L Q S E D E A D Y Y
VA2	V S N R F S G S K S G N T A S L T I S G L Q A E D E A D Y Y
VA3	I P E R F S G S N S G N T A T L T I S G T Q A E D E A D Y Y

CDRIII		framework 4	
VA1	C Q Q H Y T T P P V F G G T K L T V L G	107	A
VA2	C Q Q H Y T T P P V F G G T K L T V L G	106	
VA3	C Q Q H Y T T P P V F G G T K L T V L G	105	

Figure 2C: V heavy chain consensus sequences.

CDRII		framework 3	
VH1A	58	N	85
VH1B	59	N	84
VH2	60	Y	83
VH3	61	Y	82
VH4	62	N	81
VH5	63	R	80
VH6	64	D	79
	65		78
	66		77
	67		76
	68		75
	69		74
	70		73
	71		72
	72		71
	73		70
	74		69
	75		68
	76		67
	77		66
	78		65
	79		64
	80		63
	81		62
	82		61
	83		60
	84		59
	85		58

CDRIII		framework 4	
VH1A	86	D	113
VH1B	87	D	112
VH2	88	D	111
VH3	89	D	110
VH4	90	D	109
VH5	91	D	108
VH6	92	D	107
	93		106
	94		105
	95		104
	96		103
	97		102
	98		101
	99		100
	100		99
	101		98
	102		97
	103		96
	104		95
	105		94
	106		93
	107		92
	108		91
	109		90
	110		89
	111		88
	112		87
	113		86

Figure 3A: V kappa 1 (Vk1) gene sequence

```

.D I Q M T Q S P S S L S A S V G D
EcoRV
~~~~~
BanII
~~~~~
GATATCCAGA TGACCCAGAG CCCGTCTAGC CTGAGCGCGA GCGTGGGTGA
CTATAGGTCT ACTGGGTCTC GGCAGATCG GACTCGCGCT CGCACCCACT

R V T I T C R A S Q G I S S Y L
PstI
~~~~~
TCGTGTGACC ATTACCTGCA GAGCGAGCCA GGCATTAGC AGCTATCTGG
AGCACACTGG TAATGGACGT CTCGCTCGGT CCCGTAATCG TCGATAGACC

A W Y Q Q K P G K A P K L L I Y A
KpnI
~~~~~
SexAI
~~~~~
AseI
~~~~~
CGTGGTACCA GCAGAAACCA GGTAAGCAC CGAAACTATT AATTATGCA
GCACCATGGT CGTCTTTGGT CCATTTCGTG GCTTTGATAA TTAATAACGT

A S S L Q S G V P S R F S G S
SanDI
~~~~~
BamHI
~~~~~
GCCAGCAGCT TGCAAAGCGG GGTCCTCGTCC CGTTTATAGCG GCTCTGGATC

```

Figure 3A: V kappa 1 (Vκ1) gene sequence (continued)

CGGTCGTCGA ACGTTTCGCC CCAGGGCAGG GCAAATCGC CGAGACCTAG

G T D F T L T I S S L Q P E D F

Eco57I

~~~~~

BamHI

BbsI

~~~~~

CGGCACTGAT TTTACCCTGA CCATTAGCAG CCTGCAACCT GAAGACTTTG

GCCGTGACTA AAATGGGACT GGTAATCGTC GGACGTTGGA CTTCTGAAAC

A T Y Y C Q Q H Y T T P P T F G Q

MscI

~~~~~

CGACCTATTA TTGCCAGCAG CATTATACCA CCCC GCCGAC CTTTGGCCAG

GCTGGATAAT AACGGTCGTC GTAATATGGT GGGCGGCTG GAAACCGGTC

G T K V E I K R T

BsiWI

~~~~~

GGTACGAAAG TTGAAATTAA ACGTACG

CCATGCTTTC AACTTAATT TGCATGC

Figure 3B: V kappa 2 (Vk2) gene sequence

```

D I V M T Q S P L S L P V T P G E
EcoRV          BanII
~~~~~
GATATCGTGA TGACCCAGAG CCCACTGAGC CTGCCAGTGA CTCCGGGGCGA
CTATAGCACT ACTGGGTCTC GGGTGACTCG GACGGTCACT GAGCCCCCGCT

P A S I S C R S S Q S L L H S N
PstI
~~~~~
GCCTGCGAGC ATTAGCTGCA GAAGCAGCCA AAGCCTGCTG CATAGCAACG
CGGACGCTCG TAATCGACGT CTTCGTCGGT TTCGGACGAC GTATCGTTGC

G Y N Y L D W Y L Q K P G Q S P Q
KpnI          SexAI
~~~~~
GCTATAACTA TCTGGATTGG TACCTTCAA AACCAGGTCA AAGCCCCGAG
CGATATTGAT AGACCTAACC ATGGAAGTTT TTGGTCCAGT TTCGGGCGTC

L L I Y L G S N R A S G V P D R F
AseI          SmaDI
~~~~~
CTATTAATT ATCTGGGCAG CAACCGTGCC AGTGGGGTCC CGGATCGTTT
GATAATTAAA TAGACCCGTC GTTGGCACGG TCACCCAGG GCCTAGCAAA

```

Figure 3B: V kappa 2 (Vk2) gene sequence (continued)

S	G	S	G	S	G	T	D	F	T	L	K	I	S	R	V
BamHI															
~~~~~															
T	A	G	C	G	G	C	T	C	G	G	C	A	C	T	T
A	T	C	G	C	C	G	A	G	A	A	A	A	T	T	T
AGCGGTGTGG															
A	T	C	G	C	C	G	A	G	A	A	A	T	T	T	T
ATCGCCGACG															
C	C	T	A	A	A	T	G	G	A	A	A	T	T	T	T
TCGGCACACACC															
E	A	E	D	V	G	V	Y	Y	C	Q	Q	H	Y	T	P
Eco57I															
~~~~~															
BbsI															
~~~~~															
A	A	G	C	T	G	A	A	G	A	G	A	T	T	A	T
TACCACCCCG															
T	T	C	G	A	C	T	T	C	T	G	T	A	A	T	T
ATGTTGGGGC															
P	T	F	G	Q	G	T	K	V	E	I	K	R	T		
MscI															
~~~~~															
C	C	G	A	C	C	T	T	G	C	C	A	G	G	T	A
ATTAACGTA CG															
G	G	C	T	G	G	A	A	C	C	T	T	C	A	A	C
TAAATTGCAT GC															
BsiWI															
~~~~~															

Figure 3C: V kappa 3 (V $\kappa$ 3) gene sequence

```

D I V L T Q S P A T L S L S P G E
EcoRV                               BanII
~~~~~
GATATCGTGC TGACCCAGAG CCCGGCGACC CTGAGCCTGT CTCCGGGCGA
CTATAGCACG ACTGGGTCTC GGGCCGCTGG GACTCGGACA GAGGCCCGCT

R A T L S C R A S Q S V S S Y
PstI
~~~~~
ACGTGCGACC CTGAGCTGCA GAGCGAGCCA GAGCGTGAGC AGCAGCTATC
TGCACGCTGG GACTCGACGT CTCGCTCGGT CTCGCACTCG TCGTCGATAG

L A W Y Q Q K P G Q A P R L L I Y
KpnI                               SexAI                               AseI
~~~~~
TGGCGTGGTA CCAGCAGAAA CCAGGTCAAG CACCGCGTCT ATTAATTAT
ACCGCACCAT GGTGCTCTTT GTCCAGTTC GTGGCGCAGA TAATTAAATA

G A S S R A T G V P A R F S G S G
 SandI BamHI
~~~~~
GGCGCGAGCA GCCGTGCAAC TGGGGTCCCG GCGCGTTTTA GCGGCTCTGG

```

Figure 3C: V kappa 3 (V $\kappa$ 3) gene sequence (continued)

CCGCGGCTCGT CGGCACGTTG ACCCCAGGGC CGCGCAAAAT CGCCGAGACC

S G T D F T L T I S S L E P E D  
Eco57I  
~~~~~

BamHI
~~~~~  
BbsI  
~~~~~

ATCCGGCAGG GATTTACCC TGACCATTAG CAGCCTGGAA CCTGAAGACT
TAGGCCGTGC CTAAATGGG ACTGGTAATC GTCGGACCTT GGA CTCTGA

F A V Y Y C Q Q H Y T T P P T F G
MscI
~~~~~

TTGCGGTGTA TTATTGCCAG CAGCATTATA CCACCCCGCC GACCTTTGGC  
AACGCCACAT AATAACGGTC GTCGTAATAT GTGGGGCGG CTGAAACCG

Q G T K V E I K R T  
MscI  
~~~~~  
BsiWI
~~~~~

CAGGTACGA AAGTTGAAAT TAAACGTACG  
GTCCCATGCT TTCAACTTTA ATTGCATGC

Figure 3D: V kappa 4 (Vκ4) gene sequence

```

D I V M T Q S P D S L A V S L G E
EcoRV          BanII
~~~~~
GATATCGTGA TGACCCAGAG CCCGGATAGC CTGGCGGTGA GCCTGGGCCGA
CTATAGCACT ACTGGGTCTC GGGCCTATCG GACCGCCACT CGGACCCGCT

R A T I N C R S S Q S V L Y S S
PstI
~~~~~
ACGTGCGACC ATTAAGTGA GAAGCAGCCA GAGCGTGCTG TATAGCAGCA
TGCACGCTGG TAATTGACGT CTTCGTCGGT CTCGCACGAC ATATCGTCGT

N N K N Y L A W Y Q Q K P G Q P P
KpnI          SexAI
~~~~~
ACAACAAAA CTATCTGGCG TGTACCAGC AGAAACCAGG TCAGCCGCCG
TGTGTTTGT GATAGACCGC ACCATGGTCG TCTTTGGTCC AGTCGGCGGC

K L L I Y W A S T R E S G V P D R
AseI SmaI
~~~~~
AAACTATTAA TTTATTGGC ATCCACCCGT GAAAGCGGGG TCCCGGATCG
TTTGATAATT AAATAACCCG TAGGTGGGCA CTTTCGCCCC AGGCCTAGC

```

Figure 3D: V kappa 4 (Vκ4) gene sequence (continued)

F	S	G	S	G	S	G	T	D	F	T	L	T	I	S	S
BamHI															
~~~~~															
TTT TAGCGG C TCTGGATCCG GCACTGATTT TACCCCTGACC ATTTCGTCCC															
AAAATCGCCG AGACCTAGGC CGTGACTAAA ATGGGACTGG TAAAGCAGGG															
L	Q	A	E	D	V	A	V	Y	Y	C	Q	Q	H	Y	T
Eco57I															
~~~~~															
BbsI															
~~~~~															
TGCAAGCTGA AGACGTGGCG GTGTATTATT GCCAGCAGCA TTATACCACC															
ACGTTCGACT TCTGCACCGC CACATAATAA CGGTCGTCGT AATATGGTGG															
P	P	T	F	G	Q	G	T	K	V	E	I	K	R	T	
MscI															
~~~~~															
CCGCCGACCT TTGGCCAGGG TACGAAAGTT GAAATTAAAC GTACG															
GGCGGCTGGA AACCGGTCCC ATGCTTTCAA CTTTAATTG CATGC															
BsiWI															
~~~~~															

Figure 4A: V lambda 1 (V1) gene sequence

Q S V L T Q P P S V S G A P G Q R
SexAI

CAGAGCGTGC TGACCCAGCC GCCTTCAGTG AGTGGCGCAC CAGTTCAGCG
GTCTCGCACG ACTGGGTCGG CGGAAGTCAC TCACCGCGTG GTCCAGTCGC
Eco57I

V T I S C S G S S S N I G S N Y
BssSI

TGTGACCATC TCGTGAGCG GCAGCAGCAG CAACATTGGC AGCAACTATG
ACACTGGTAG AGCACATCGC CGTCGTCGTC GTTGTAAACCG TCGTTGATAC

V S W Y Q Q L P G T A P K L L I Y
KpnI XmaI BbeI

TGAGCTGGTA CCAGCAGTTG CCCGGGACGG CGCCGAAACT GCTGATTAT
ACTCGACCAT GGTGTCACAC GGGCCCTGCC GCGGCTTGA CGACTAAATA

D N N Q R P S G V P D R F S G S K
Bsu36I BamHI

Figure 4A: V lambda 1 (Vλ1) gene sequence (continued)

GATAACAACC AGCGTCCCTC AGGCGTGCCG GATCGTTTA GCGGATCCAA
 CTATTGTTGG TCGCAGGGAG TCCGCACGGC CTAGCAAAAT CGCCTAGGTT

S G T S A S L A I T G L Q S E D
 BbsI

~~~~~

AAGCGGACC AGCGGAGCC TTGCGATTAC GGGCCTGCAA AGCGAAGACG  
 TTCGCCGTGG TCGCGCTCGG AACGCTAATG CCCGGACGTT TCGCTTCTGC

E A D Y Y C Q Q H Y T T P P V F G  
 AAGCGGATTA TTATTGCCAG CAGCATTATA CCACCCCGCC TGTGTTTGGC  
 TTCGCCCTAAT AATAACGGTC GTCGTAATAT GGTGGGGCGG ACACAAACCG

G G T K L T V L G  
 HpaI MscI  
 ~~~~~  
 GGCGGCACGA AGTTAACCGT TCTTGGC
 CCGCCGTGCT TCAATTGGCA AGAACCG

Figure 4B: V lambda 2 (Vλ2) gene sequence

Q	S	A	L	T	Q	P	A	S	V	S	G	S	P	G	Q	S
SexAI																
~~~~~																
CAGAGCGCAC	TGACCCAGCC	AGCTTCAGTG	AGCGGCTCAC	CAGGTCAGAG												
GTCTCGCGTG	ACTGGGTCGG	TCGAAGTCAC	TCGCCGAGTG	GTCCAGTCTC												
Eco57I																
~~~~~																
I	T	I	S	C	T	G	T	S	S	D	V	G	G	Y	N	
BssSI																
~~~~~																
CATTACCATC	TCGTGTACGG	GTA CTAGCAG	CGATGTGGGC	GGCTATAACT												
GTAATGGTAG	AGCACATGCC	CATGATCGTC	GCTACACCCG	CCGATATTGA												
Y	V	S	W	Y	Q	Q	H	P	G	K	A	P	K	L	M	I
KpnI																
~~~~~																
ATGTGAGCTG	GTACCAGCAG	CATCCCGGGA	AGCGGCCGAA	ACTGATGATT												
TACACTCGAC	CATGTCGTC	GTAGGCCCT	TCCGCGGCTT	TGACTACTAA												
Y	D	V	S	N	R	P	S	G	V	S	N	R	F	S	G	S
Bsu36I																
~~~~~																
TATGATGTGA	GCAACCGTCC	CTCAGGCGTG	AGCAACCGTT	TTAGCGGATC												
ATACTACACT	CGTTGGCAGG	GAGTCCGCAC	TCGTTGGCAA	AATCGCCTAG												
BamHI																
~~~~~																

Figure 4B: V lambda 2 (Vλ2) gene sequence (continued)

K	S	G	N	T	A	S	L	T	I	S	G	L	Q	A	E
BamHI															
~~~~~															
C	A	A	A	G	C	G	C	A	A	C	C	G	C	G	A
G	T	T	T	C	G	C	G	T	G	G	C	G	C	T	G
CAAGCGGAAG															
G	T	T	T	C	G	C	G	T	G	G	C	G	C	T	G
GTTCCGCTTC															
D	E	A	D	Y	Y	C	Q	Q	H	Y	T	T	P	P	V
F															
BbsI															
~~~~~															
A	C	G	A	A	G	C	G	C	G	A	T	T	A	T	T
T	G	C	T	T	C	G	C	T	A	A	T	A	A	C	G
GCCGTGTGTTT															
G	G	G	T	K	L	T	V	L	G						
HpaI										MscI					
~~~~~										~~~~~					
G	G	G	G	G	C	A	A	G	T	A	A	C	G	T	T
C	C	G	C	G	C	C	G	T	T	C	A	A	T	T	G
GCAAGAACC															

Figure 4C: V lambda 3 (Vλ3) gene sequence

S	Y	E	L	T	Q	P	P	S	V	S	V	A	P	G	Q	T
SexAI																
~~~~~																
AGCTATGAAC	TGACCCAGCC	GCCTTCAGTG	AGCGTTGCAC	CAGGTCAGAC												
TCGATACTTG	ACTGGGTCGG	CGGAAGTCAC	TCGCAACGTG	GTCCAGTCTG												
Eco57I																
~~~~~																
A	R	I	S	C	S	G	D	A	L	G	D	K	Y	A	S	
BssSI																
~~~~~																
CGCGCGTATC	TCGTGTAGCG	CGCATGCGCT	GGCGGATAAA	TACGCGAGCT												
GCGCGCATAG	AGCACATCGC	CGCTACGCGA	CCCGCTATTT	ATGCGGCTCGA												
W	Y	Q	Q	K	P	G	Q	A	P	V	L	V	I	Y	D	D
KpnI																
~~~~~																
XmaI																
~~~~~																
BbeI																
~~~~~																
GGTACCAGCA	GAAACCCGGG	CAGCGGCCAG	TTCTGGTGAT	TTATGATGAT												
CCATGGTCGT	CTTTGGGCCC	GTCCGCGGTC	AAGACCACTA	AATACTACTA												

Figure 4C: V lambda 3 (Vλ3) gene sequence (continued)

```

S D R P S G I P E R F S G S N S G
      Bsu36I      BamHI
TCTGACCGTC CCTCAGGCAT CCCGGAACGC TTAGCGGAT CCAACAGCGG
AGACTGGCAG GGAGTCCGTA GGCCTTGGC AAATCGCCTA GGTGTGCGCC
      ~~~~~
N T A T L T I S G T Q A E D E A
 BbsI
CAACACCGCG ACCCTGACCA TTAGCGGCAC TCAGGCGGAA GACGAAGCGG
GTTGTGGCGC TGGGACTGGT AATCGCCGTG AGTCCGCCTT CTGCTTCGCC
      ~~~~~
D Y Y C Q Q H Y T P P V F G G G
ATTATTATTG CCAGCAGCAT TATACCACCC CGCCTGTGTT TGGCGGCGGC
TAATAATAAC GGTGTCGTA ATATGTGGG GCGGACACAA ACCGCCGCCG
      ~~~~~
T K L T V L G
 HpaI MscI
      ~~~~~
ACGAAGTTAA CCGTCTTGG C
TGCTTCAATT GGCAAGAACC G

```

Figure 5A: V heavy chain 1A (VH1A) gene sequence

```

Q V Q L V Q S G A E V K K P G S S
MfeI
~~~~~
CAGGTGCAAT TGGTTCAGTC TGGCGCGGAA GTGAAAAAAC CGGGCAGCAG
GTCCACGTTA ACCAAGTCAG ACCGCGCCTT CACTTTTTTG GCCCGTCGTC

V K V S C K A S G G T F S S Y A
BspEI
~~~~~
CGTGAAAGTG AGCTGCAAAG CCTCCGGAGG CACTTTTAGC AGCTATGCCA
GCACTTTCAC TCGACGTTTC GGAGGCCCTCC GTGAAAATCG TCGATACGCT

I S W V R Q A P G Q G L E W M G G
BstXI XhoI
~~~~~
TTAGCTGGGT GCGCCAAGCC CCTGGGCAGG GTCTCGAGTG GATGGCGGC
AATCGACCCA CGCGGTTCGG GGACCCGTC CAGAGCTCAC CTACCCGCCG

I I P I F G T A N Y A Q K F Q G R
ATTATTCCGA TTTTGGCAC GCGGAACACTAC GCGCAGAAGT TTCAGGGCCG
TAATAAGGCT AAAAACCGTG CCGCTTGATG CGCGTCTTCA AAGTCCCGGC

V T I T A D E S T S T A Y M E L
BstEII

```

Figure 5A: V heavy chain 1A (VH1A) gene sequence (continued)

```

~~~~~
GGTGACCATT ACCGCGGATG AAAGCACCAG CACCGCGTAT ATGGAACCTGA
CCACTGGTAA TGGCGCCTAC TTTCGTGGTC GTGGCGCATA TACCTTGACT

S S L R S E D T A V Y Y C A R W G
          EagI      BssHII
          ~~~~~
GCAGCCTGCG TAGCGAAGAT ACGCCCGTGT ATTATTGCGC GCGTTGGGGC
CGTCGGACGC ATCGCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

G D G F Y A M D Y W G Q G T L V T
 StyI
          ~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

V S S
  BpI
  ~~~~~
GGTAGCTCA G
CCAATCGAGT C

```

Figure 5B: V heavy chain 1B (VH1B) gene sequence

```

Q V Q L V Q S G A E V K K P G A S
MfeI
~~~~~
CAGGTGCAAT TGGTTCAGAG CGGCGCGGAA GTGAAAAAAC CGGGCGCGGAG
GTCCACGTTA ACCAAGTCTC GCCGCGCCTT CACTTTTGTG GCCCGCGCTC

V K V S C K A S G Y T F T S Y Y
BspEI
~~~~~
CGTGAAAGTG AGCTGCAAAG CCTCCGGATA TACCTTTACC AGCTATTATA
GCACTTTCAC TCGACGTTTC GGAGGCCTAT ATGGAATGG TCGATAATAT

M H W V R Q A P G Q G L E W M G W
BstXI
~~~~~
TGCAC TGGGT CCGCCAAGCC CCTGGGCAGG GTCTCGAGTG GATGGGCTGG
ACGTGACCCA GCGGTTTCGG GGACCCGTCC CAGAGCTCAC CTACCCGACC

I N P N S G G T N Y A Q K F Q G R
ATAACCCGA ATAGCGGCGG CACGAAC TAC GCGCAGAAGT TTCAGGGCCG
TAATTGGGCT TATCGCCGCC GTGCTTGATG CCGCTCTCA AAGTCCCGGC

```

Figure 5B: V heavy chain 1B (VH1B) gene sequence (continued)

```

V   T   M   T   R   D   T   S   I   S   T   A   Y   M   E   L
BstEII
~~~~~
GGTGACCATG ACCCGTGATA CCAGCATTAG CACCGCGTAT ATGGAAGTGA
CCACTGGTAC TGGGCACTAT GGTCGTAATC GTGGCGCATA TACCTTGACT

S S L R S E D T A V Y Y C A R W G
EagI
~~~~~
BssHII
~~~~~
GCAGCCTGCG TAGCGAAGAT ACGGCCGTGT ATTATTGCGC GCGTTGGGGC
CGTCGGACGC ATCGCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

G D G F Y A M D Y W G Q G T L V T
StyI
~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CTAATAAACC CCGGTTCCGT GGGACCACTG

V   S   S
B1pI
~~~~~
GGTTAGCTCA G
CCAATCGAGT C

```

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Figure 5C: V heavy chain 2 (VH2) gene sequence

```

Q V Q L K E S G P A L V K P T Q T
MfeI
~~~~~
CAGGTGCAAT TGAAGAAG CGGCCCGGCC CTGGTGAAAC CGACCCAAAC
GTCCACGTTA ACTTCTTTC GCCGGGCCGG GACCACTTTG GCTGGGTTTG

L T L T C T F S G F S L S T S G
BspEI
~~~~~
CCTGACCCCTG ACCTGTACCT TTTCGGGATT TAGCCTGTCC ACGTCTGGCG
GGACTGGGAC TGGACATGGA AAAGGCCTAA ATCGGACAGG TGCAGACCCG

V G V G W I R Q P P G K A L E W L
BstXI XhoI
~~~~~
TTGGCGTGGG CTGGATTGCG CAGCCGCCCTG GGAAAGCCCT CGAGTGGCTG
AACCGCACCC GACCTAAGCG GTCGGCGGAC CCTTTCGGGA GCTCACCCGAC

A L I D W D D D K Y Y S T S L K T
MluI
~~~~~
GCTCTGATTG ATTGGGATGA TGATAAGTAT TATAGCACCA GCCTGAAAC
CGAGACTAAC TAACCCCTACT ACTATTCTATA ATATCGTGGT CGGACTTTTG

```

Figure 5C: V heavy chain 2 (VH2) gene sequence (continued)

```

R L T I S K D T S K N Q V V L T
MluI NspV

GCGTCTGACC ATTAGCAAAG ATACTTCGAA AAATCAGGTG GTGCTGACTA
CGCAGACTGG TAATCGTTTC TATGAAGCCTT TTAGTCCAC CACGACTGAT

M T N M D P V D T A T Y Y C A R W
 BssHII

TGACCAACAT GGACCCGGTG GATACGGCCA CCTATTATTG CGCGCGTTGG
ACTGGTTGTA CCTGGGCCAC CTATGCCGGT GGATAATAAC GCGCGCAACC

G G D G F Y A M D Y W G Q G T L V
 StyI

GGCGGCGATG GCTTTTATGC GATGGATTAT TGGGGCCAAG GCACCCTGGT
CCGCCGCTAC CGAAATATACG CTACCTAATA ACCCCGGTTC CGTGGGACCA

T V S S
 BlnI

GACGGTTAGC TCAG
CTGCCAATCG AGTC

```

Figure 5D: V heavy chain 3 (VH3) gene sequence

```

E V Q L V E S G G G L V Q P G G S
MfeI

GAAGTGCAAT TGGTGAAAG CGGCGGCGGC CTGGTGCAAC CGGGCGGCAG
CTTCACGTTA ACCACCTTTC GCCGCCGCCG GACCACGTTG GCCCGCCGTC

L R L S C A A S G F T F S S Y A
BspEI

CCTGCGTCTG AGCTGCGCGG CCTCCGGATT TACCTTAGC AGCTATGCGA
GGACGCAGAC TCGACGCGCC GGAGGCCTAA ATGGAATCG TCGATACGCT

M S W V R Q A P G K G L E W V S A
BstXI XhoI

TGAGCTGGGT GCGCCAAGCC CCTGGGAAGG GTCTCGAGTG GGTGAGCGCG
ACTCGACCCA CGCGGTTCGG GGACCCCTCC CAGAGCTCAC CCACTCGCGC

I S G S G G S T Y Y A D S V K G R
ATTAGCGGTA GCGCGGCAG CACCTATTAT GCGGATAGCG TGAAGGCCG
TAATCGCCAT CGCGCCGTC GTGGATAATA CGCCTATCGC ACTTCCGCGC

```

Figure 5D: V heavy chain 3 (VH3) gene sequence (continued)

```

F T I S R D N S K N T L Y L Q M
 PmlI NspV
      ~~~~~
TTTTACCATT TCACGTGATA ATTCGAAAAA CACCTGTAT CTGCAATGA
AAAATGGTAA AGTGCACTAT TAAGCTTTT GTGGACATA GACGTTTACT

N S L R A E D T A V Y C A R W G
      EagI      BssHII
      ~~~~~
ACAGCCTGCG TCGGAAGAT ACGCCCGTGT ATTATTGCGC GCGTTGGGC
TGTCGGACGC ACGCCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

G D G F Y A M D Y W G Q G T L V T
 StyI
      ~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

V S S
      BlnI
      ~~~~~
GGTAGCTCA G
CCAATCGAGT C

```

Figure 5E: V heavy chain 4 (VH4) gene sequence

```

Q V Q L Q E S G P G L V K P S E T
 MfeI
~~~~~
CAGGTGCAAT TGCAAGAAAG TGGTCCGGGC CTGGTGAAAC CGAGCGAAAC
GTCCACGTTA ACGTTCTTTC ACCAGGCCCG GACCACTTTG GCTCGCTTTG

L  S  L  T  C  T  V  S  G  G  S  I  S  S  Y  Y
      BspEI
~~~~~
CCTGAGCCTG ACCTGCACCG TTTCGGGAGG CAGCATTAGC AGCTATTATT
GGA CTGGAC TGGACGTGGC AAAGGCCTCC GTCGTAATCG TCGATAATAA

W S W I R Q P P G K G L E W I G Y
 BstXI
~~~~~
GGAGCTGGAT TCGCCAGCCG CCTGGGAAGG GTCTCGAGTG GATTGGCTAT
CCTCGACCCTA AGCGGTCGGC GGACCCTTCC CAGAGCTCAC CTAACCGATA

I  Y  Y  S  G  S  T  N  Y  N  P  S  L  K  S  R  V
      BstEII
~~~~~
ATTTATTATA GCGGCAGCAC CAACTATAAT CCGAGCCTGA AAAGCCGGGT
TAAATAATAT CGCCGTCGTG GTTGATATTA GGCTCGGACT TTTCGGCCCA

```

Figure 5E: V heavy chain 4 (VH4) gene sequence (continued)

```

 T I S V D T S K N Q F S L K L S
BstEII
~~~~~
GACCATTAGC GTTGATACTT CGAAAACCA GTTAGCCTG AAAC TGAGCA
CTGGTAATCG CAACTATGAA GCTTTTGGT CAAATCGGAC TTTGACTCGT

S V T A A D T A V Y Y C A R W G G
      EagI BssHII
~~~~~
GCGTGACGGC GCGGATACG GCCGTGTATT ATTGCGCGCG TTGGGGCGGC
CGCACTGCCG CCGCCTATGC CGGCACATAA TAACGCGCGC AACCCCGCCG

D G F Y A M D Y W G Q G T L V T V
 StyI
~~~~~
GATGGCTTTT ATGCGATGGA TTATTGGGC CAAGGCACCC TGGTGACGGT
CTACCGAAAA TACGCTACCT AATAACCCCG GTTCCGTGGG ACCACTGCCA

```

```

S S
BlpI
~~~~~
TAGCTCAG
ATCGAGTC

```

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Figure 5F: V heavy chain 5 (VH5) gene sequence

```

E V Q L V Q S G A E V K K P G E S
MfeI
~~~~~
GAAGTGCAAT TGGTTCAGAG CGGCGCGGAA GTGAAAAAAC CGGCGGAAAG
CTTCACGTTA ACCAAGTCTC GCCGCGCCTT CACTTTTGTG GCCCGCTTTC

L K I S C K G S G Y S F T S Y W
BspEI
~~~~~
CCTGAAAATT AGCTGCAAAG GTTCCGGGATA TTCCTTTACG AGCTATTGGA
GGACTTTTAA TCGACGTTTC CAAGGCCCTAT AAGGAAATGC TCGATAACCT

I G W V R Q M P G K G L E W M G I
BstXI XhoI
~~~~~
TTGGCTGGGT GCGCCAGATG CCTGGGAAGG GTCTCGAGTG GATGGGCATT
AACCGACCCA CGCGGTCTAC GGACCCCTTCC CAGAGCTCAC CTACCCGTAA

I Y P G D S D T R Y S P S F Q G Q
ATTATCCGG GCGATAGCGA TACCCGTTAT TCTCCGAGCT TTCAGGGCCA
TAAATAGGCC CGCTATCGCT ATGGGCAATA AGAGGCTCGA AAGTCCCGGT

```

Figure 5F: V heavy chain 5 (VH5) gene sequence (continued)

```

V   T   I   S   A   D   K   S   I   S   T   A   Y   L   Q   W
BstEII
~~~~~
GGTGACCATT AGCGGGGATA AAAGCATTAG CACCGCGTAT CTTCAATGGA
CCACTGGTAA TCGCGCCTAT TTTCGTAATC GTGGCGCATA GAAGTTACCT

S S L K A S D T A M Y Y C A R W G
BssHII
~~~~~
GCAGCCTGAA AGCGAGCGAT ACGGCCATGT ATTATTGCGC GCGTTGGGGC
CGTCGGACTT TCGCTCGCTA TGCCGGTACA TAATAACGCG CGCAACCCCG

G   D   G   F   Y   A   M   D   Y   W   G   Q   G   T   L   V   T
StyI
~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

V S S
BlpI
~~~~~
GGTTAGCTCA G
CCAATCGAGT C

```

Figure 5G: V heavy chain 6 (VH6) gene sequence

```

Q V Q L Q Q S G P G L V K P S Q T
MfeI
~~~~~
CAGGTGCAAT TGCAACAGTC TGTCCGGGC CTGGTGAAC CGAGCCAAAC
GTCCACGTTA ACGTTGTCAG ACCAGGCCCG GACCACTTTG GCTCGGTTTG

L S L T C A I S G D S V S S N S
BspEI
~~~~~
CCTGAGCCTG ACCTGTGCGA TTTCCGGAGA TAGCGTGAGC AGCAACAGCG
GGACTCGGAC TGGACACGCT AAAGGCCTCT ATCGCACTCG TCGTTGTCCG

A A W N W I R Q S P G R G L E W L
BstXI XhoI
~~~~~
CGGCGTGGAA CTGGATTTCG CAGTCTCCTG GCGGTGGCCT CGAGTGGCTG
GCCGCACCTT GACCTAAGCG GTCAGAGGAC CCGCACCGGA GTCACCGAC

G R T Y Y R S K W Y N D Y A V S V
GGCCGTACCT ATTATCGTAG CAAATGGTAT AACGATTATG CGGTGAGCGT
CCGGCATGGA TAATAGCATC GTTTACCATA TTGCTAATAC GCCACTCGCA

```

Figure 5G: V heavy chain 6 (VH6) gene sequence (continued)

```

K S R I T I N P D T S K N Q F S
 BsaBI NspV
      ~~~~~
GAAAAGCCGG ATTACCATCA ACCCGGATAC TTCGAAAAC CAGTTAGCC
CTTTTCGGCC TAATGGTAGT TGGGCTATG AAGCTTTTG GTCAAATCGG

L Q L N S V T P E D T A V Y C A
      EagI      BssHII
      ~~~~~
TGCAACTGAA CAGCGTGACC CCGGAAGATA CGGCCGTGTA TTATTGCGCG
ACGTTGACTT GTCGCACTGG GGCCTTCTAT GCCGGCACAT AATAACGCGC

R W G G D G F Y A M D Y W G Q G T
 BssHII StyI
      ~~~~~
CGTTGGGGCG GCGATGGCTT TTATGCGATG GATTATTGG GCCAAGGCAC
GCAACCCCGC CGTACCGAA AATACGCTAC CTAATAACCC CGGTTCCGTG

L V T V S S
      BlnI
      ~~~~~
CCTGGTGACG GTTAGCTCAG
GGACCACTGC CAATCGAGTC

```

Figure 6: oligonucleotides for gene synthesis

**O1K1** 5' - GAATGCATACGCTGATATCCAGATGACCCAGAG-  
CCCGTCTAGCCTGAGC -3'

**O1K2** 5' - CGCTCTGCAGGTAATGGTCACACGATCACCCAC-  
GCTCGCGCTCAGGCTAGACGGGC -3'

**O1K3** 5' - GACCATTACCTGCAGAGCGAGCCAGGGCATTAG-  
CAGCTATCTGGCGTGGTACCAGCAG -3'

**O1K4** 5' - CTTTGCAAGCTGCTGGCTGCATAAATTAATAGT-  
TTCGGTGCTTTACCTGGTTTCTGCTGGTACCACGCCAG -3'

**O1K5** 5' - CAGCCAGCAGCTTGCAAAGCGGGGTCCCGTCCC-  
GTTTTAGCGGCTCTGGATCCGGCACTGATTTTAC -3'

**O1K6** 5' - GATAATAGGTCGCAAAGTCTTCAGGTTGCAGGC-  
TGCTAATGGTCAGGGTAAAATCAGTGCCGGATCC -3'

**O2K1** 5' - CGATATCGTGATGACCCAGAGCCCCTGAGCCT-  
GCCAGTGACTCCGGGCGAGCC -3'

**O2K2** 5' - GCCGTTGCTATGCAGCAGGCTTTGGCTGCTTCT-  
GCAGCTAATGCTCGCAGGCTCGCCCGGAGTCAC -3'

**O2K3** 5' - CTGCTGCATAGCAACGGCTATAACTATCTGGAT-  
TGGTACCTTCAAAAACCAGGTCAAAGCCC -3'

**O2K4** 5' - CGATCCGGGACCCCACTGGCACGGTTGCTGCCC-  
AGATAAATTAATAGCTGCGGGCTTTGACCTGGTTTTTG -3'

**O2K5** 5' - AGTGGGGTCCCGGATCGTTTTAGCGGCTCTGGA-  
TCCGGCACCGATTTTACCCTGAAAATTAGCCGTGTG -3'

**O2K6** 5' - CCATGCAATAATACACGCCACGTCTTCAGCTT-  
CCACACGGCTAATTTTCAGGG -3'

**O3K1** 5' - GAATGCATACGCTGATATCGTGCTGACCCAGAG-  
CCCGG -3'

**O3K2** 5' - CGCTCTGCAGCTCAGGGTCGCACGTTGCCCCG-  
AGACAGGCTCAGGGTCGCCGGGCTCTGGGTCAGC -3'

**O3K3** 5' - CCCTGAGCTGCAGAGCGAGCCAGAGCGTGAGCA-  
GCAGCTATCTGGCGTGGTACCAG -3'

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Figure 6: (continued)

**O3K4** 5' - GCACGGCTGCTCGCGCCATAAATTAATAGACGC-  
GGTGCTTGACCTGGTTTCTGCTGGTACCACGCCAGATAG -3'

**O3K5** 5' - GCGCGAGCAGCCGTGCAACTGGGGTCCCGGCCG-  
GTTTTAGCGGCTCTGGATCCGGCACGGATTTTAC -3'

**O3K6** 5' - GATAATACACCGCAAAGTCTTCAGGTTCCAGGC-  
TGCTAATGGTCAGGGTAAAATCCGTGCCGGATC -3'

**O4K1** 5' - GAATGCATACGCTGATATCGTGATGACCCAGAG-  
CCCGGATAGCCTGGCG -3'

**O4K2** 5' - GCTTCTGCAGTTAATGGTCGCACGTTGCCCCAG-  
GCTCACCGCCAGGCTATCCGGGC -3'

**O4K3** 5' - CGACCATTAAGTGCAGAAGCAGCCAGAGCGTGC-  
TGTATAGCAGCAACAACAAAACCTATCTGGCGTGGTACCAG -  
3'

**O4K4** 5' - GATGCCCAATAAATTAATAGTTTCGGCGGCTGA-  
CCTGGTTTCTGCTGGTACCACGCCAGATAG -3'

**O4K5** 5' - AAATATTAATTTATTGGGCATCCACCCGTGAA-  
AGCGGGGTCCCGGATCGTTTTAGCGGCTCTGGATCCGGCAC-  
3'

**O4K6** 5' - GATAATACACCGCCACGTCTTCAGCTTGCAGGG-  
ACGAAATGGTCAGGGTAAAATCAGTGCCGGATCCAGAGCC -  
3'

**O1L1** 5' - GAATGCATACGCTCAGAGCGTGCTGACCCAGCC-  
GCCTTCAGTGAGTGG -3'

**O1L2** 5' - CAATGTTGCTGCTGCTGCCGCTACACGAGATGG-  
TCACACGCTGACCTGGTGCGCCACTCACTGAAGGCGGC -3'

**O1L3** 5' - GGCAGCAGCAGCAACATTGGCAGCAACTATGTG-  
AGCTGGTACCAGCAGTTGCCCCGGGAC -3'

**O1L4** 5' - CCGGCACGCCTGAGGGACGCTGGTTGTTATCAT-  
AAATCAGCAGTTTCGGCGCCGTCCCGGGCAACTGC -3'

**O1L5** 5' - CCCTCAGGCGTGCCGGATCGTTTTAGCGGATCC-  
AAAAGCGGCACCAGCGCGAGCCTTGCG -3'

Figure 6: (continued)

O1L6 5' - CCGCTTCGTCTTCGCTTTGCAGGCCCGTAATCG-  
CAAGGCTCGCGCTGG -3'

O2L1 5' - GAATGCATACGCTCAGAGCGCACTGACCCAGCC-  
AGCTTCAGTGAGCGGC -3'

O2L2 5' - CGCTGCTAGTACCCGTACACGAGATGGTAATGC-  
TCTGACCTGGTGAGCCGCTCACTGAAGCTGG -3'

O2L3 5' - GTACGGGTACTAGCAGCGATGTGGGCGGCTATA-  
ACTATGTGAGCTGGTACCAGCAGCATCCCCG -3'

O2L4 5' - CGCCTGAGGGACGGTTGCTCACATCATAAATCA-  
TCAGTTTCGGCGCCTTCCCGGGATGCTGCTGGTAC -3'

O2L5 5' - CAACCGTCCCTCAGGCGTGAGCAACCGTTTTAG-  
CGGATCCAAAAGCGGCAACACCGCGAGCC -3'

O2L6 5' - CCGCTTCGTCTTCCGCTTGCAGGCCGCTAATGG-  
TCAGGCTCGCGGTGTTGCCG -3'

O3L1 5' - GAATGCATACGCTAGCTATGAACTGACCCAGCC-  
GCCTTCAGTGAGCG -3'

O3L2 5' - CGCCCAGCGCATCGCCGCTACACGAGATACGCG-  
CGGTCTGACCTGGTGCAACGCTCACTGAAGGCGGC -3'

O3L3 5' - GGCGATGCGCTGGGCGATAAATACGCGAGCTGG-  
TACCAGCAGAAACCCGGGCAGGCGC -3'

O3L4 5' - GCGTTCCGGGATGCCTGAGGGACGGTCAGAATC-  
ATCATAAATCACCAGAACTGGCGCCTGCCCCGGGTTTC -3'

O3L5 5' - CAGGCATCCCGGAACGCTTTAGCGGATCCAACA-  
GCGGCAACACCGCGACCCTGACCATTAGCGG -3'

O3L6 5' - CCGCTTCGTCTTCCGCTGAGTGCCGCTAATGG-  
TCAGGGTC -3'

O1246H1 5' - GCTCTTCACCCCTGTTACCAAAGCCCAG-  
GTGCAATTG -3'

O1AH2 5' - GGCTTTGCAGCTCACTTTCACGCTGCTGCCCCGG-  
TTTTTTCACCTCCGCGCCAGACTGAACCAATTGCACCTGGGC-  
TTTG -3'

Figure 6: (continued)

**O1AH3** 5' - GAAAGTGAGCTGCAAAGCCTCCGGAGGCACTTT-  
TAGCAGCTATGCGATTAGCTGGGTGCGCCAAGCCCCTGGGCAG  
GGTC -3'

**O1AH4** 5' - GCCCTGAAACTTCTGCGCGTAGTTCGCCGTGCC-  
AAAAATCGGAATAATGCCGCCCATCCACTCGAGACCCTGCCC-  
AGGGGC -3'

**O1AH5** 5' - GCGCAGAAGTTTCAGGGCCGGGTGACCATTACC-  
GCGGATGAAAGCACCAGCACC GCGTATATGGA ACTGAGCAGCC  
TGCG -3'

**O1ABH6** 5' - GCGCGCAATAATACACGGCCGTATCTTCGCT-  
ACGCAGGCTGCTCAGTTCC -3'

**O1BH2** 5' - GGCTTTGCAGCTCACTTTCACGCTCGCGCCCGG-  
TTTTTTC ACTTCCGCGCCGCTCTGAACCAATTGCACCTGGGC-  
TTTG -3'

**O1BH3** 5' - GAAAGTGAGCTGCAAAGCCTCCGGATATACCTT-  
TACCAGCTATTATATGCACTGGGTCCGCCAAGCCCCTGGGCAG  
GGTC -3'

**O1BH4** 5' - GCCCTGAAACTTCTGCGCGTAGTTCGTGCCGCC-  
GCTATTCGGGTTAATCCAGCCCATCCACTCGAGACCCTGCCCCA  
GGGC -3'

**O1BH5** 5' - GCGCAGAAGTTTCAGGGCCGGGTGACCATGACC-  
CGTGATAACCAGCATTAGCACCGCGTATATGGA ACTGAGCAGCC  
TGCG -3'

**O2H2** 5' - GGTACAGGTCAGGGTCAGGGTTTGGGTCCGTTT-  
CACCAGGGCCGGGCCGCTTTCTTTCAATTGCACCTGGGCTTTG  
-3'

**O2H3** 5' - CTGACCCTGACCTGTACCTTTTCCGGATTTAGC-  
CTGTCCACGTCTGGCGTTGGCGTGGGCTGGATTCGCCAGCCGC  
CTGGGAAAG -3'

**O2H4** 5' - GCGTTTTTCAGGCTGGTGCTATAATACTTATCAT-  
CATCCCAATCAATCAGAGCCAGCCACTCGAGGGCTTTCCCAGG  
CGGCTGG -3'

Figure 6: (continued)

**O2H5** 5' - GCACCAGCCTGAAAACGCGTCTGACCATTAGCA-  
AAGATACTTCGAAAAATCAGGTGGTGCTGACTATGACCAACAT  
GG -3'

**O2H6** 5' - GCGCGCAATAATAGGTGGCCGTATCCACCGGGT-  
CCATGTTGGTCATAGTCAGC -3'

**O3H1** 5' - CGAAGTGCAATTGGTGGAAAGCGGCGGCGGCCT-  
GGTGCAACCGGGCGGCAG -3'

**O3H2** 5' - CATAGCTGCTAAAGGTAAATCCGGAGGCCGCGC-  
AGCTCAGACGCAGGCTGCCGCCCGGTTGCAC -3'

**O3H3** 5' - GATTTACCTTTAGCAGCTATGCGATGAGCTGGG-  
TGCGCCAAGCCCCTGGGAAGGGTCTCGAGTGGGTGAG -3'

**O3H4** 5' - GGCCTTTCACGCTATCCGCATAATAGGTGCTGC-  
CGCCGCTACCGCTAATCGCGCTCACCCACTCGAGACCC -3'

**O3H5** 5' - CGGATAGCGTGAAAGGCCGTTTTACCATTTCAC-  
GTGATAATTTCGAAAAACACCCTGTATCTGCAAATGAACAG-3'

**O3H6** 5' - CACGCGCGCAATAATACACGGCCGTATCTTCCG-  
CACGCAGGCTGTTTCATTTGCAGATACAGG -3'

**O4H2** 5' - GGTCAGGCTCAGGGTTTCGCTCGGTTTCACCAG-  
GCCCCGACCACTTTCTTGCAATTGCACCTGGGCTTTG -3'

**O4H3** 5' - GAAACCCTGAGCCTGACCTGCACCGTTTCCGGA-  
GGCAGCATTAGCAGCTATTATTGGAGCTGGATTCGCCAGCCGC  
-3'

**O4H4** 5' - GATTATAGTTGGTGCTGCCGCTATAATAAATAT-  
AGCCAATCCACTCGAGACCCTTCCCAGGCGGCTGGCGAATCCA  
G -3'

**O4H5** 5' - CGGCAGCACCAACTATAATCCGAGCCTGAAAAG-  
CCGGGTGACCATTAGCGTTGATACTTCGAAAAACCAGTTTAGC  
CTG -3'

**O4H6** 5' - GCGCGCAATAATACACGGCCGTATCCGCCGCCG-  
TCACGCTGCTCAGTTTCAGGCTAAACTGGTTTTTCG -3'

Figure 6: (continued)

**05H1** 5' - GCTCTTCACCCCTGTTACCAAAGCCGAAGTGCA-  
ATTG -3'

**05H2** 5' - CCTTTGCAGCTAATTTTCAGGCTTTCGCCCCGGT-  
TTTTTCACTTCCGCGCCGCTCTGAACCAATTGCACTTCGGCTT  
TGG -3'

**05H3** 5' - CCTGAAAATTAGCTGCAAAGGTTCCGGATATTC-  
CTTTACGAGCTATTGGATTGGCTGGGTGCGCCAGATGCCTGG  
-3'

**05H4** 5' - CGGAGAATAACGGGTATCGCTATCGCCCCGGATA-  
AATAATGCCCATCCACTCGAGACCCTTCCCAGGCATCTGGCGC  
AC -3'

**05H5** 5' - CGATACCCGTTATTCTCCGAGCTTTCAGGGCCA-  
GGTGACCATTAGCGCGGATAAAAGCATTAGCACCGCGTATCTT  
C -3'

**05H6** 5' - GCGCGCAATAATACATGGCCGTATCGCTCGCTT-  
TCAGGCTGCTCCATTGAAGATACGCGGTGCTAATG -3'

**06H2** 5' - GAAATCGCACAGGTCAGGCTCAGGGTTTGGCTC-  
GGTTTCACCAGGCCCCGGACCAGACTGTTGCAATTGCACCTGG-  
GCTTTG -3'

**06H3** 5' - GCCTGACCTGTGCGATTTCCGGAGATAGCGTGA-  
GCAGCAACAGCGCGGCGTGGAAGTTCGCCAGTCTCCTGG  
GCG -3'

**06H4** 5' - CACCGCATAATCGTTATACCATTTGCTACGATA-  
ATAGGTACGGCCCAGCCACTCGAGGCCACGCCCAGGAGACTG-  
GCG -3'

**06H5** 5' - GGTATAACGATTATGCGGTGAGCGTGAAAAGCC-  
GGATTACCATCAACCCGGATACTTCGAAAAACCAGTTTAGCCT  
GC -3'

**06H6** 5' - GCGCGCAATAATACACGGCCGTATCTTCCGGGG-  
TCACGCTGTTCAAGTTGCAGGCTAAACTGGTTTTTC -3'

**OCLK1** 5' - GGCTGAAGACGTGGGCGTGTATTATTGCCAGCA-  
GCATTATACCACCCCGCCGACCTTTGGCCAGGGTAC -3'

Figure 6: (continued)

OCLK2 5' - GCGGAAAAATAAACACGCTCGGAGCAGCCACCG-  
TACGTTTAATTTCAACTTTCGTACCCTGGCCAAAGGTC -3'

OCLK3 5' - GAGCGTGTTTATTTTTCCGCCGAGCGATGAACA-  
ACTGAAAAGCGGCACGGCGAGCGTGGTGTGCCTGCTG -3'

OCLK4 5' - CAGCGCGTTGTCTACTTTCCACTGAACTTTCGC-  
TTCACGCGGATAAAAGTTGTTTCAGCAGGCACACCACGC -3'

OCLK5 5' - GAAAGTAGACAACGCGCTGCAAAGCGGCAACAG-  
CCAGGAAAGCGTGACCGAACAGGATAGCAAAGATAG -3'

OCLK6 5' - GTTTTTTCATAATCCGCTTTGCTCAGGGTCAGGG-  
TGCTGCTCAGAGAATAGGTGCTATCTTTGCTATCCTGTTTCG -  
3'

OCLK7 5' - GCAAAGCGGATTATGAAAAACATAAAGTGTATG-  
CGTGCGAAGTGACCCATCAAGGTCTGAGCAGCCCCGGTG -3'

OCLK8 5' - GGCATGCTTATCAGGCCTCGCCACGATTAAAAG-  
ATTTAGTCACCGGGCTGCTCAGAC -3'

OCH1 5' - GGCGTCTAGAGGCCAAGGCACCCTGGTGACGGT-  
TAGCTCAGCGTCGAC -3'

OCH2 5' - GTGCTTTTGCTGCTCGGAGCCAGCGGAAACACG-  
CTTGACCTTTGGTCGACGCTGAGCTAACC -3'

OCH3 5' - CTCCGAGCAGCAAAAGCACCAGCGGCGGCACGG-  
CTGCCCTGGGCTGCCTGGTTAAAGATTATTTCC -3'

OCH4 5' - CTGGTCAGCGCCCCGCTGTTCCAGCTCACGGTG-  
ACTGGTTCCGGGAAATAATCTTTAACCAGGCA -3'

OCH5 5' - AGCGGGGCGCTGACCAGCGGCGTGACATACCTTT-  
CCGGCGGTGCTGCAAAGCAGCGGCCTG -3'

OCH6 5' - GTGCCTAAGCTGCTGCTCGGCACGGTCACAACG-  
CTGCTCAGGCTATACAGGCCGCTGCTTTGCAG -3'

OCH7 5' - GAGCAGCAGCTTAGGCACTCAGACCTATATTTG-  
CAACGTGAACCATAAACCGAGCAACACC -3'

OCH8 5' - GCGCGAATTCGCTTTTCGGTTCCACTTTTTTAT-  
CCACTTTGGTGTGCTCGGTTTATGG -3'

Figure 7A: sequence of the synthetic Cx gene segment

```

 ° V A A A P S V F I F P P S D E Q
 BsiWI

CGTACGGTGG CTGCTCCGAG CGTGTTTATT TTTCCGCCGA GCGATGAACA
GCATGCCACC GACGAGGCTC GCACAAATAA AAAGCGGCT CGCTACTTGT

 L K S G T A S V V C L L N N F Y
ACTGAAAAGC GGCACGGCGA GCGTGGTGTG CCTGCTGAAC AACTTTTATC
TGACTTTTCG CCGTGCCGCT CGCACCCACAC GGACGACTTG TTGAAAATAG

 P R E A K V Q W K V D N A L Q S G
CGCGTGAAGC GAAAGTTCAG TGGAAAGTAG ACAACGCGCT GCAAAGCGGC
GGCACTTCG CTTTCAAGTC ACCTTTCATC TGTTGCCGA CGTTTCGCCG

 N S Q E S V T E Q D S K D S T Y S
AACAGCCAGG AAAGCGTGAC CGAACAGGAT AGCAAAGATA GCACCTATTC
TTGTCGGTCC TTTCCGCACTG GCTTGTCCTA TCGTTTCTAT CGTGGATAAG

 L S S T L T L S K A D Y E K H K
TCTGAGCAGC ACCCTGACCC TGAGCAAAGC GGATTATGAA AAACATAAAG
AGACTCGTCG TGGGACTGGG ACTCGTTTCG CTAATACTT TTTGTATTTC

```

Figure 7A: sequence of the synthetic Cx gene segment (continued)

V Y A C E V T H Q G L S S P V T K  
 TGTATGCGTG CGAAGTGACC CATCAAGGTC TGAGCAGCCCC GGTGACTAAA  
 ACATACGCAC GCTTCACTGG GTAGTCCAG ACTCGTCGGG CCACTGATTT

S F N R G E A *  
 StuI SphI  
 -----  
 TCCTTTAATC GTGGCGAGGC CTGATAAGCA TGC  
 AGAAATTAG CACCGCTCCG GACTATTCGT ACG

Figure 7B: sequence of the synthetic CH1 gene segment

```

A S T K G P S V F P L A P S S
BlpI Sali
~~~~~
GCTCAGCGTC GACCAAAGGT CCAAGCGTGT TTCCGCTGGC TCCGAGCAGC
CGAGTCGCAG CTGGTTTCCA GGTTCGCACA AAGGCGACCG AGGCTCGTCG

K S T S G G T A A L G C L V K D Y
AAAAGCACCA GCGCGGCAC GGCTGCCCTG GGTGCCCTGG TTAAGATTA
TTTTCGTGGT CGCGCCCGTG CCGACGGGAC CCGACGGACC AATTCTAAT

F P E P V T V S W N S G A L T S
TTTCCCGGAA CCAGTCACCG TGAGCTGGAA CAGCGGGCGG CTGACCAGCG
AAAGGGCCTT GGTCA GTGC ACTCGACCTT GTCGCCCGC GACTGGTCGC

G V H T F P A V L Q S S G L Y S L
GCGTGCATAC CTTCCGGCG GTGCTGCAAA GCAGCGGCCT GTATAGCCTG
CGCACGTATG GAAAGGCCG CACGACGTTT CGTCGCCGGA CATATCGGAC

S S V V T V P S S S L G T Q T Y I
AGCAGCGTTG TGACCGTGCC GAGCAGCAGC TTAGGCACTC AGACCTATAT
TCGTCGCAAC ACTGGCACGG CTCGTCGTCG AATCCGTGAG TCTGGATATA

```

Figure 7B: sequence of the synthetic CH1 gene segment (continued)

C	N	V	N	H	K	P	S	N	T	K	V	D	K	K	V
TTGCAACGTG	AACCATAAAC	CGAGCAACAC	CAAAGTGGAT	AAAAAAGTGG											
AACGTTGCAC	TTGGTATTG	GCTCGTTGTG	GTTTCACCTA	TTTTTTCACC											

E	P	K	S	E	F	*
				EcoRI		HindIII
				~~~~~		~~~~~
AACCGAAAAG	CGAATTCTGA	TAAGCTT				
TTGGCTTTC	GCTTAAGACT	ATTCGAA				

Figure 7C: functional map and sequence of module 24 comprising the synthetic Cλ gene segment (huCL lambda)

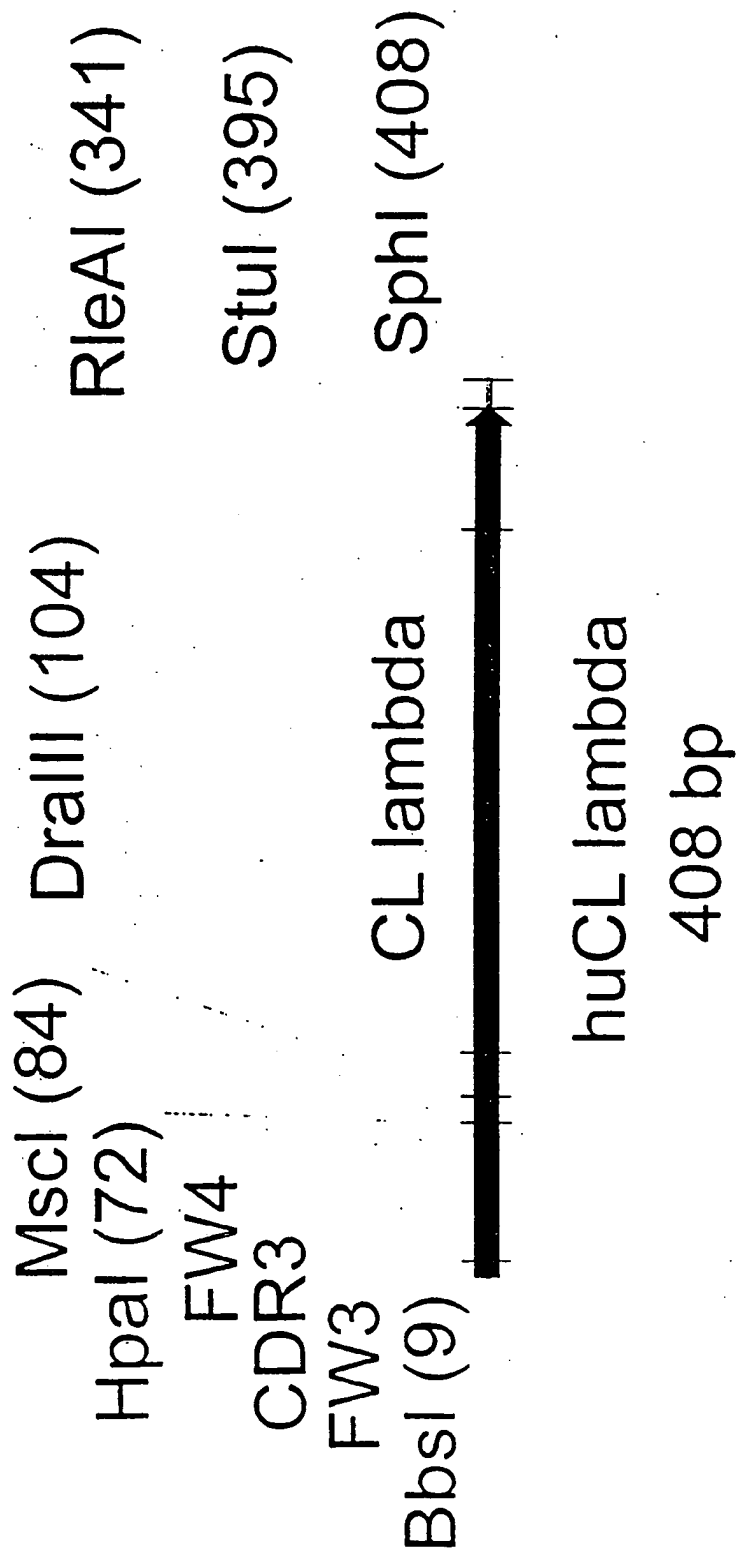


Figure 7C: functional map and sequence of module 24 comprising the synthetic Cl gene segment (huCL lambda) (continued)

Bbs I		Hpa I		Msc I		Dra III	
~~~~~		~~~~~		~~~~~		~~~~~	
1	GAAGACGAAG CGGATTATTA TTGCCAGCAG CATTATACCA CCCGCGCTGT						
	CTTCTGCTTC GCCTAATAAT AACGGTCGTC GTAATATGGT GGGGCGGACA						
~~~~~		~~~~~		~~~~~		~~~~~	
51	GTTTGGCGC GGCACGAAGT TAACCGTTCT TGGCCAGCCG AAAGCCGCAC						
	CAAACCGCCG CCGTGCTTCA ATTGGCAAGA ACCGGTCGGC TTTCGGCGTG						
~~~~~		~~~~~		~~~~~		~~~~~	
101	CGAGTGTGAC GCTGTTTCCG CCGAGCAGCG AAGAATTGCA GGCGAACAAA						
	GCTCACACTG CGACAAAGGC GGCTCGTCGC TTCTTAACGT CCGCTTGTTT						
~~~~~		~~~~~		~~~~~		~~~~~	
151	GGACCCCTGG TGTGCCTGAT TAGCGACTTT TATCCGGGAG CCGTGACAGT						
	CGCTGGGACC ACACGACTA ATCGCTGAAA ATAGGCCCTC GGCACTGTCA						
~~~~~		~~~~~		~~~~~		~~~~~	
201	GGCCTGGAAG GCAGATAGCA GCCCCGTCAA GCGGGGAGTG GAGACCACCA						
	CCGGACCTTC CGTCTATCGT CGGGGCAGTT CCGCCCTCAC CTCTGGTGGT						

Figure 7C: functional map and sequence of module 24 comprising the synthetic CI gene segment (huCl lambda) (continued)

251 CACCCTCCAA ACAAGCAAC AACAGTACG CGGCCAGCAG CTATCTGAGC  
GTGGGAGGTT TGTTCGTTG TTGTTTCATGC GCCGGTCGTC GATAGACTCG

RleAI

~~~~~

301 CTGACGCCCTG AGCAGTGGAA GTCCACACAGA AGCTACAGCT GCCAGGTCAC
GACTGCGGGAC TCGTCACCTT CAGGGTGTCT TCGATGTCGA CGGTCCAGTG

StuI

~~~~~

351 GCATGAGGGG AGCACC GTGG AAAAACC GT TGC GCCGACT GAGGCC TGAT  
CGTACTCCCC TCGTGGCACC TTTT TTTGGCA ACGCGGCTGA CTCCGGACTA

SphI

~~~~~

401 AAGCATGC
TTCGTACG

Figure 7D: oligonucleotides used for synthesis of module M24 containing Cλ gene segment

M24: assembly PCR

M24-A: GAAGACAAGCGGATTATTATGGCCAGCAGCATTATACCAACCCGCCCTGTGTTGGCGGCG-
GCACGAAGTTAACCGTTC

M24-B: CAATTCTCGCTGCTCGGCGGAACAGCGTCACACTCGGTGCGGCTTCGGCTGGCCAA-
GAACGGTTAACTTCGTGCCGC

M24-C: CGCCGAGCAGCGAAGAATTGCAGGCGAACAAAGCGACCCCTGGTGTGCCCTGATTAGCGACT-
TTTATCCGGGAGCCGTGACA

M24-D: TGTTGGAGGGTGTGGTGTCTCCACTCCCGCCTTGACGGGGCTGCTAICTGCCCTCCAG-
GCCACTGTCACGGCTCCCGG

M24-E: CCACACCTCCAAACAAGCAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGACGC-
CTGAGCAGTGGAAGTCCACAGAAGCTACAGCTG

M24-F: GCATGCTTATCAGGCCCTCAGTCGGCGCAACGGTTTTTCCACGGTGTCCCTCATGCCGT-
GACCTGGCAGCTGTAGCTTC

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vk2

| | | | | | | | | | | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------|------------|-------------|-------------|
| M | K | Q | S | T | I | A | L | A | L | L | P | L | L | F | T | P | | | |
| | | | | | | | | | | | | | | | | SapI | | | |
| | | | | | | | | | | | | | | | | ----- | | | |
| ATGAAACAAA | | | | | | | | | | | | | | | | GCACTATTGC | ACTGGCACTC | TTACCGTTGC | TCTTCACCCC |
| TACTTTGTTT | | | | | | | | | | | | | | | | CGTGATAACG | TGACCGTGAG | AATGGCAACG | AGAAGTGGGG |
| V | T | K | A | D | Y | K | D | E | V | Q | L | V | E | S | G | | | | |
| | | | | | | | | | | | | | | | | MfeI | | | |
| | | | | | | | | | | | | | | | | ----- | | | |
| TGTTACCAAA | | | | | | | | | | | | | | | | GCCGACTACA | AAGATGAAGT | GCAATTGGTG | GAAAGCGGCG |
| ACAATGGTTT | | | | | | | | | | | | | | | | CGGCTGATGT | TTCTACTTCA | CGTTAACCCAC | CTTTCGCCCG |
| G | G | L | V | Q | P | G | G | S | L | R | L | S | C | A | A | S | | | |
| | | | | | | | | | | | | | | | | BspEI | | | |
| | | | | | | | | | | | | | | | | ---- | | | |
| GCGGCCTGGT | | | | | | | | | | | | | | | | GCAACCGGGC | GGCAGCCTGC | GTCTGAGCTG | CGCGGCCCTCC |
| CGCCGGACCA | | | | | | | | | | | | | | | | CGTTGGCCCCG | CCGTCGGACG | CAGACTCGAC | GCGCCGGAGG |
| G | F | T | F | S | S | Y | A | M | S | W | V | R | Q | A | P | G | | | |
| | | | | | | | | | | | | | | | | BspEI | | | |
| | | | | | | | | | | | | | | | | ---- | | | |
| GGATTACCT | | | | | | | | | | | | | | | | TTAGCAGCTA | TCCGATGAGC | TGGGTGCGCC | AAGCCCCCTGG |
| CCTAAATGGA | | | | | | | | | | | | | | | | AATCGTCGAT | ACGCTACTCG | ACCCACGCGG | TTCGGGGACC |

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vk2 (continued)

```

      K  G  L  E  W  V  S  A  I  S  G  S  G  S  T
      XhoI
      -----
GAAGGGTCTC GAGTGGGTGA GCGCGATTAG CCGTAGCGGC GGCAGCACCT
CTTCCCAGAG CTCACCCACT CCGGCTAATC GCCATCGCCG CCGTCGTGGA

Y  Y  A  D  S  V  K  G  R  F  T  I  S  R  D  N  S
      PmlI      NspV
      -----
ATTATGCGGA TAGCGTGAAA GGCCGTTTAA CCATTTCACG TGATAATTCTG
TAATACGCCT ATCGCACTTT CCGGC AAAAT GGTAAAGTGC ACTATTAAGC

K  N  T  L  Y  L  Q  M  N  S  L  R  A  E  D  T  A
      NspV      EagI
      -----
AAAAACACCC TGTATCTGCA AATGAACAGC CTGCGTGCGG AAGATACGGC
TTTTTGTTGG ACATAGACGT TTAAGTGTCTG GACGCACGCC TTCTATGCCG

V  Y  Y  C  A  R  W  G  G  D  G  F  Y  A  M  D
      EagI      BssHII
      -----
CGTGTATTAT TCGCGCGGTT GGGCGGCGGA TGGCTTTTAT GCGATGGATT

```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vk2 (continued)

```

GCACATAATA ACGCGCGCAA CCCGCGGCT ACCGAAATA CGCTACCTAA
Y W G Q G T L V T V S S A G G G S
                                     B1pI
                                     -----
                                     -----
ATTGGGGCCA AGCACCCCTG GTGACGGTTA GCTCAGCGGG TGGCGGTTCT
TAACCCCGGT TCCGTGGGAC CACTGCCAAT CGAGTCGCCC ACCGCCAAGA

G G G G S G G G G G S G G G S D I
                                     EcorV
                                     -----
GGCGGCGGTG GGAGCGGTGG CCGTGTTCTT GCGGGTGGTG GTTCCGATAT
CCGCGGCCAC CCTCGCCACC GCCACCAAGA CCGCCACCAC CAAGGCTATA

V M T Q S P L S L P V T P G E P
EcorV BanII
-----
CGTGATGACC CAGAGCCAC TGAGCCTGCC AGTGA CTCCG GCGAGCCTG
GCACTACTGG GTCTCGGGTG ACTCGGACGG TCACTGAGGC CCGCTCGGAC

A S I S C R S S Q S L L H S N G Y
                                     PstI
                                     -----
CGAGCATTAG CTGCAGAAGC AGCCAAAGCC TGCTGCATAG CAACGGCTAT
GCTCGTAATC GACGTCTTCG TCGGTTTCGG ACGACGTATC GTTGCCGATA

```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vk2 (continued)

```

N Y L D W Y L Q K P G Q S P Q L L
      kpnI      SexAI      AseI
      -----
AACTATCTGG ATGGGTACCT TCAAAAACCA GTCAAAGCC CGCAGCTATT
TTGATAGACC TAACCATGGA AGTTTTCGT CCAGTTTCGG GCGTCGATAA

      I Y L G S N R A S G V P D R F S
      AseI      Eco109I
      -----
AATTATCTG GGCAGCAACC GTGCCAGTGG GTCCC GGAT CGTTTAGCG
TTAAATAGAC CCGTCGTTGG CACGGTCACC CCAGGGCCTA GCAAAATCGC

      G S G S G T D F T L K I S R V E A
      BamHI
      -----
GCTCTGGATC CGGCACCGAT TTACCCTGA AAATTAGCCG TGTGGAAGCT
CGAGACCTAG GCCGTGGCTA AAATGGGACT TTAATCGGC ACACCTTCGA

      E D V G V Y Y C Q Q H Y T T P P T
      BbsI
      -----
GAAGACGTGG GCGTGATTA TTGCCAGCAG CATTATACCA CCCC GCCGAC
CTTCTGCACC CGCACATAAT AACGGTCGTC GTAATATGGT GGGCGGCTG

```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vk2 (continued)

| | | | | | | | | | | | | | |
|-------------|------------|------------|-------------|-----|---|---|---|---|---|---|---|---|---|
| F | G | Q | G | T | K | V | E | I | K | R | T | E | F |
| MSCI | | | | | | | | | | | | | |
| ----- | | | | | | | | | | | | | |
| CTTTGGCCAG | GGTACGAAAG | TTGAAATTAA | ACGTACGGAA | TTC | | | | | | | | | |
| GAAACCGGTC | CCATGCTTTC | AACTTTAATT | TGCATGCCCTT | AAG | | | | | | | | | |
| BsiWI ECORI | | | | | | | | | | | | | |
| ----- | | | | | | | | | | | | | |

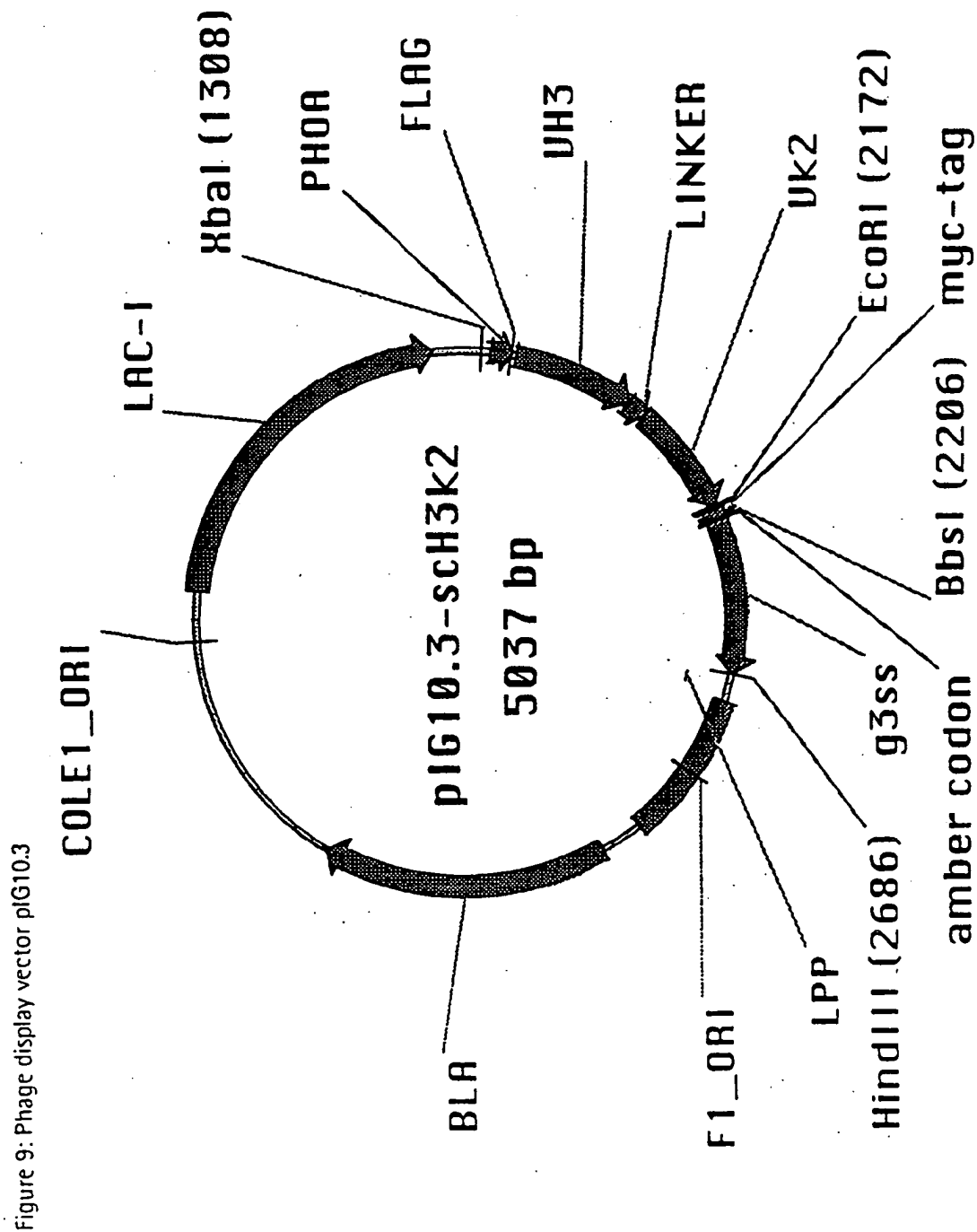


Figure 10: Sequence analysis of initial libraries

| | | | | | | | | | | | | | |
|---|------|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 103 | W | W | W | W | W | W | W | W | W | W | W | W |
| | 102 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| | 101 | D | D | D | D | D | D | D | D | D | D | D | D |
| | 100E | M | - | - | - | - | - | - | - | - | - | - | - |
| | 100D | - | - | - | - | - | - | - | - | - | - | - | - |
| | 100C | - | - | - | - | - | - | - | - | - | - | - | - |
| | 100B | A | - | - | - | - | - | - | - | - | - | - | - |
| | 100A | Y | - | - | - | - | - | - | - | - | - | - | - |
| | 100 | F | Y | H | H | R | Y | P | - | S | K | A | D |
| | 99 | G | N | W | Y | A | G | Q | R | N | S | A | Y |
| | 98 | D | M | E | L | K | T | A | T | R | D | F | Q |
| | 97 | G | K | T | E | L | T | E | I | N | G | T | P |
| B | 96 | G | G | R | R | F | N | N | A | Y | V | K | A |
| | 95 | W | F | H | V | K | W | I | T | W | S | S | V |
| | 94 | R | R | R | R | R | R | R | R | R | R | R | R |
| | 93 | A | A | A | A | A | A | A | A | A | A | A | A |
| | 92 | C | C | C | C | C | C | C | C | C | C | C | C |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Figure 10: Sequence analysis of initial libraries

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C | C | C | C | C | C | C | C | C | C | C | C |
| A | A | A | A | A | A | A | A | A | A | A | A |
| R | R | R | R | R | R | R | R | R | R | R | R |
| Y | M | K | T | Y | * | R | M | K | S | Y | |
| F | A | N | Q | P | G | N | K | G | W | A | |
| V | L | Q | S | Y | S | P | P | S | T | G | |
| H | R | M | F | R | G | W | M | E | N | T | |
| F | A | V | W | S | S | N | L | F | D | T | |
| L | S | F | E | N | E | V | N | L | K | F | |
| Y | G | H | Q | F | H | N | R | E | P | K | |
| T | K | A | Q | F | W | Y | D | T | N | Q | |
| M | Y | R | K | M | S | L | G | D | F | G | |
| V | I | K | V | P | I | H | T | V | I | P | |
| M | M | F | M | M | F | F | M | M | M | M | |
| D | D | D | D | D | D | D | D | D | D | D | |
| V | V | V | Y | V | V | V | V | Y | V | Y | |
| W | W | W | W | W | W | W | W | W | W | W | |

Figure 11: Expression analysis of initial library

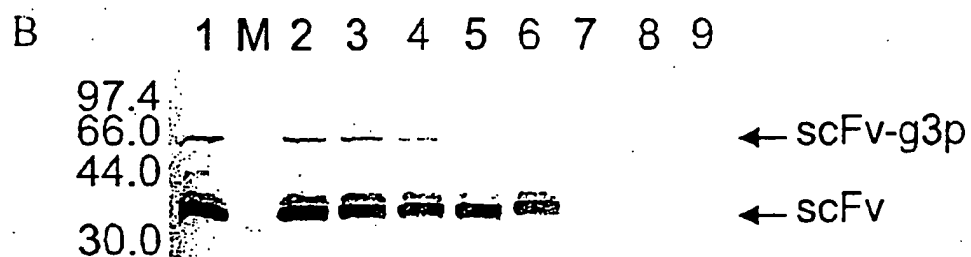
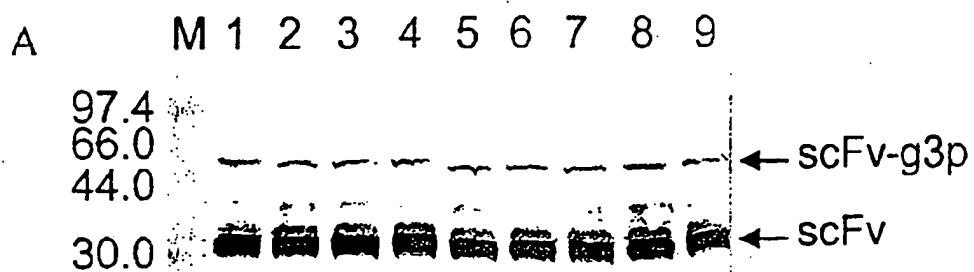


Figure 12: Increase of specificity during the panning rounds

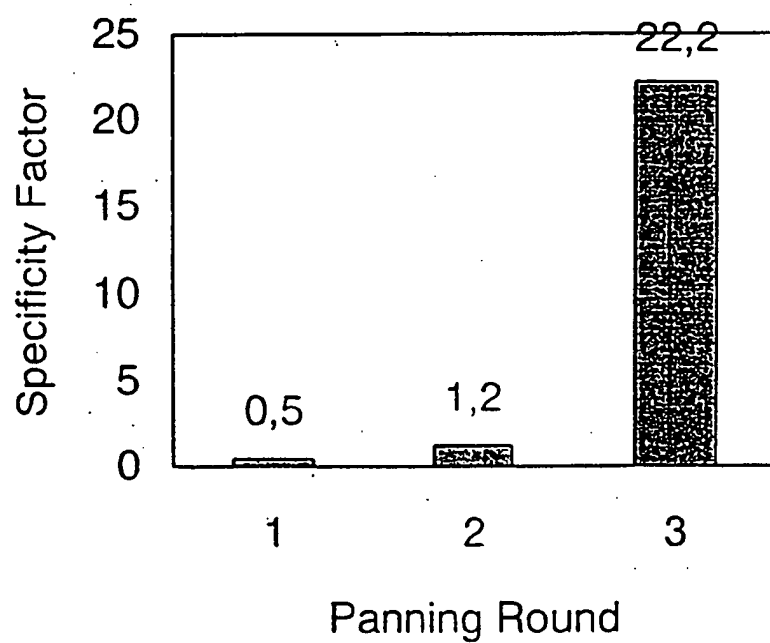


Figure 13: Phage ELISA of clones after the 3rd round of panning

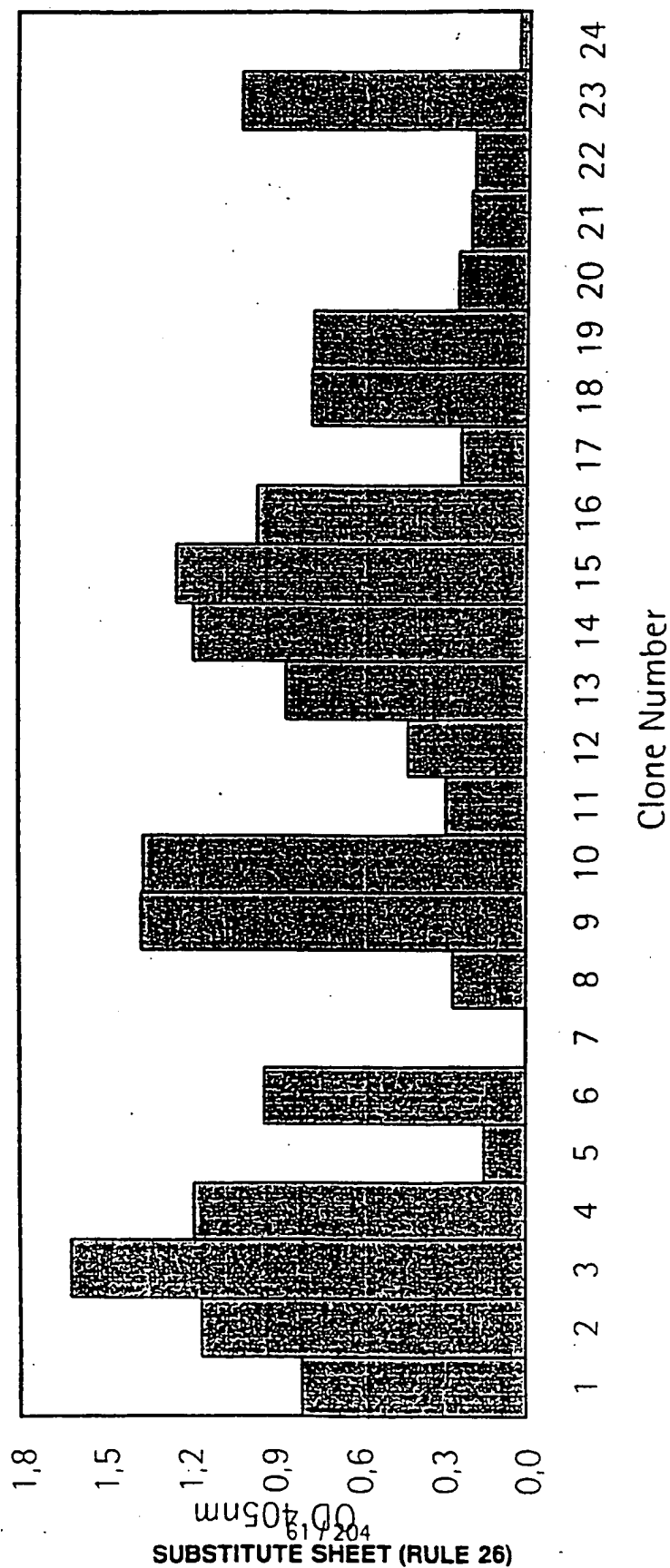


Figure 14: Competition ELISA

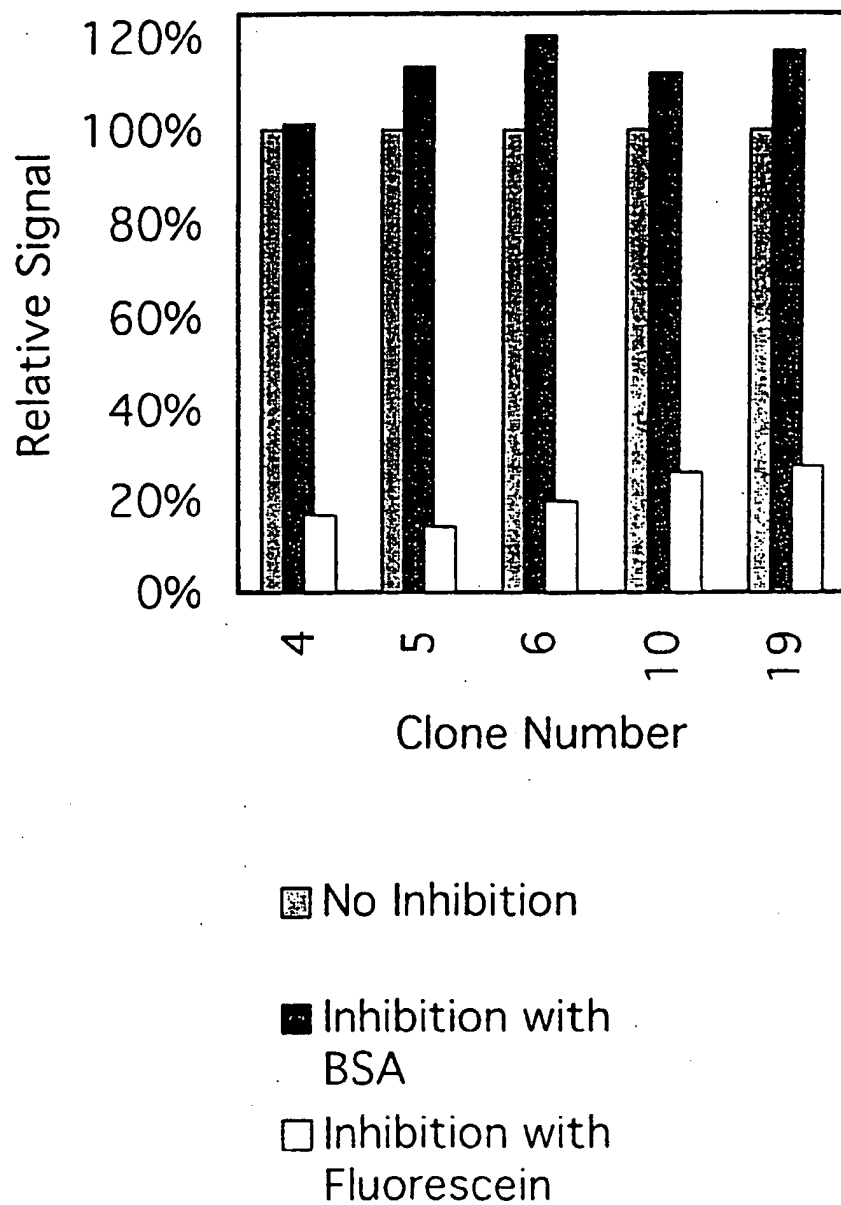


Figure 15: Sequence analysis of fluorescein binders

| Frequency | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 103 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 102 | > | > | > | > | > | > | > | Y | Y | > | > | > | > | > | > | Y |
| 101 | D | D | D | D | D | D | D | D | D | D | D | D | D | D | D | D |
| 100E | F | F | F | F | F | M | F | F | F | F | F | F | F | F | F | F |
| 100D | R | R | R | R | S | Q | V | K | Y | R | R | R | I | Q | R | R |
| 100C | F | R | H | R | N | D | A | V | K | D | N | P | K | K | A | S |
| 100B | R | M | R | K | K | F | K | T | V | M | M | R | R | R | F | F |
| 100A | P | K | L | I | W | S | K | S | R | R | R | A | K | P | S | T |
| 100 | N | R | H | R | K | P | L | Y | S | R | G | F | G | Y | R | Y |
| 99 | Q | K | R | K | M | H | F | R | R | W | R | K | K | T | R | Q |
| 98 | N | Q | K | R | I | V | M | H | M | S | R | K | H | I | K | K |
| 97 | M | K | G | M | K | E | P | F | T | R | P | K | V | H | T | L |
| 96 | R | S | N | K | R | I | K | K | K | K | N | G | M | K | W | K |
| 95 | K | R | R | R | Y | L | R | R | R | K | R | K | R | R | R | K |
| 94 | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 93 | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A |
| 92 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |

Figure 16: Purification of fluorescein binding scFv fragments

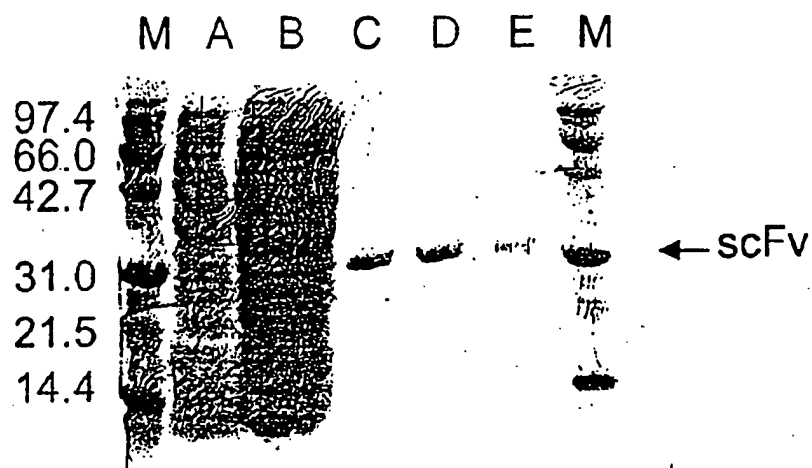
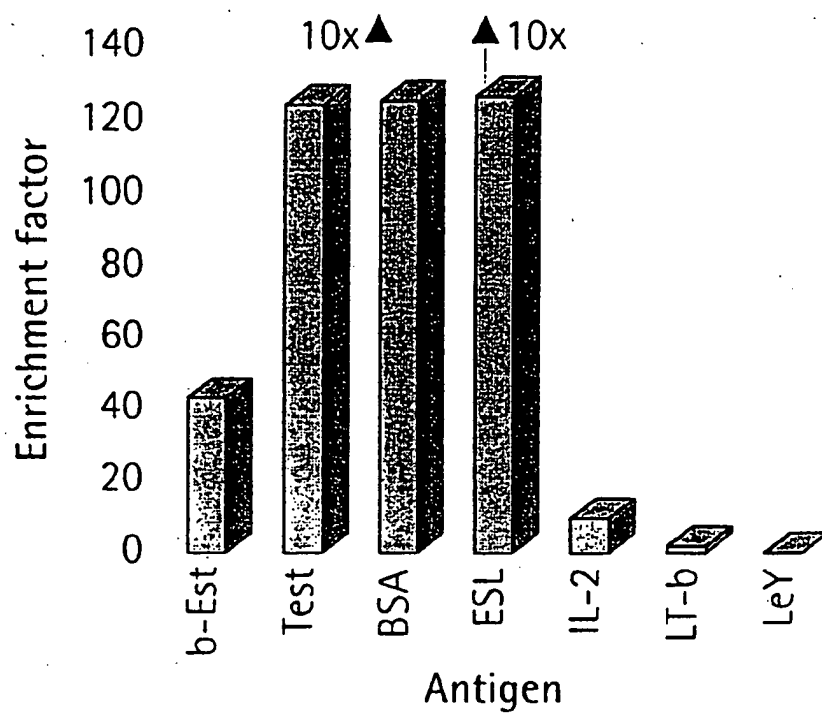


Figure 17: Enrichment factors after three rounds of panning



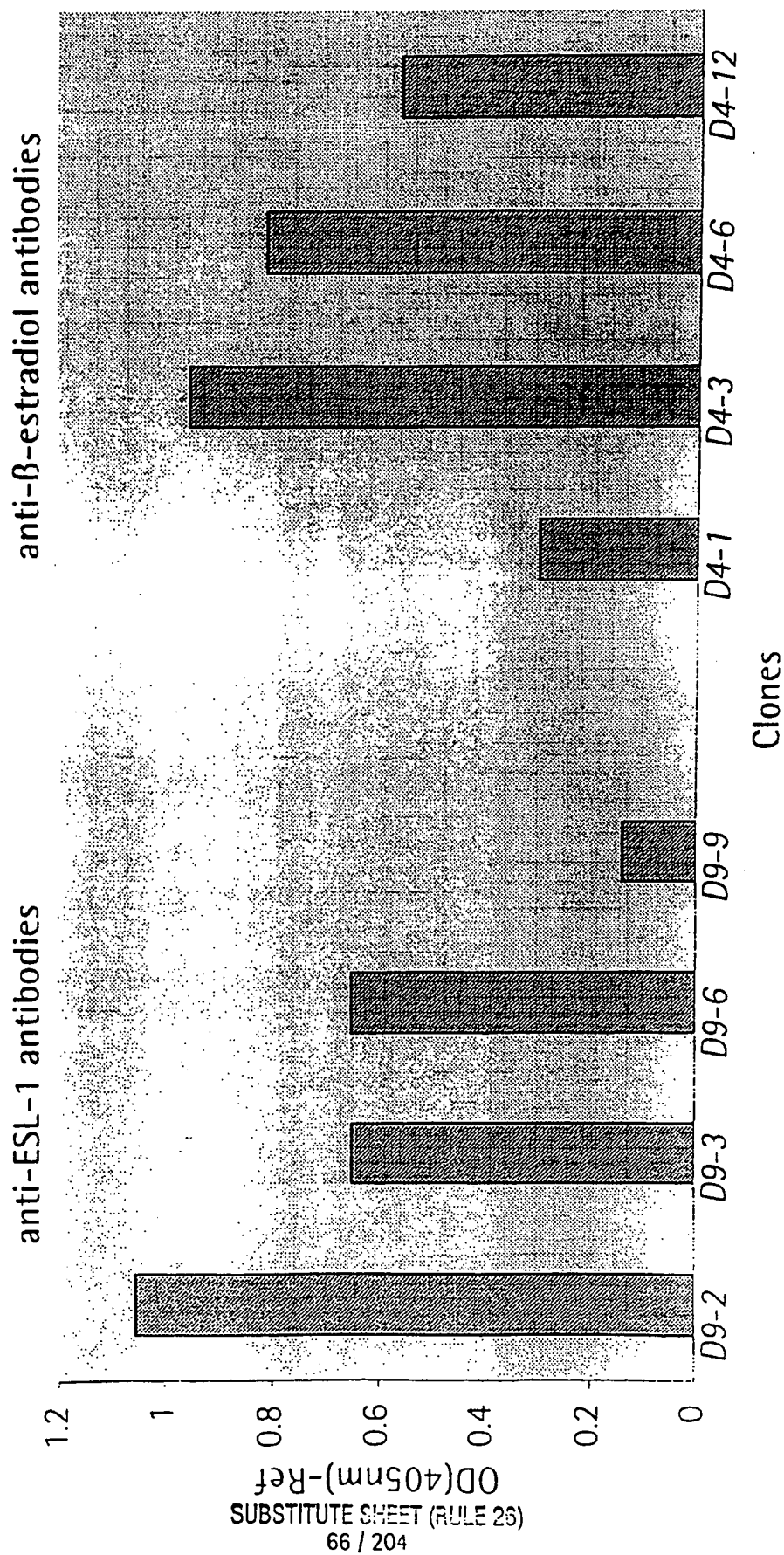


Figure 18: ELISA of anti-ESL-1 and anti- β -estradiol antibodies

Figure 19: Selectivity and cross-reactivity of HuCAL antibodies

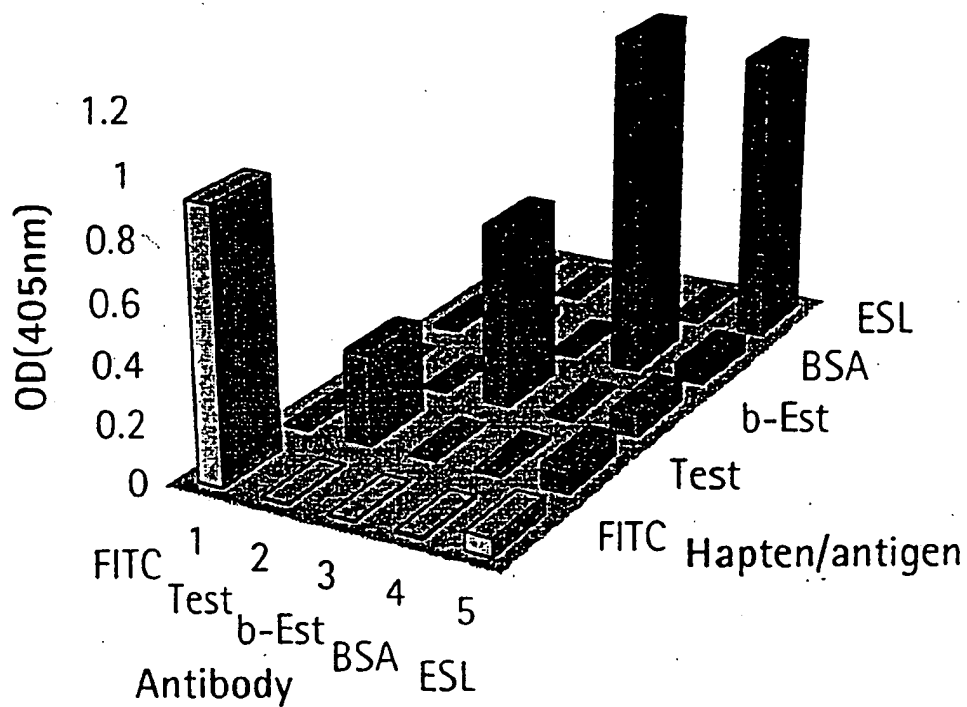


Figure 20: Sequence analysis of estradiol binders

| Frequency | 103 | 102 | 101 | 100E | 100D | 100C | 100B | 100A | 100 | 99 | 98 | 97 | 96 | 95 | 94 | 93 | 92 |
|-----------|-----|-----|-----|------|------|------|------|------|-----|----|----|----|----|----|----|----|----|
| 3 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 8 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 7 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 5 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 4 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |
| 1 | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W | W |

Figure 21: Sequence analysis of testosterone binders

| | Frequency |
|------|-------------|
| 103 | W W W W W W |
| 102 | Y Y Y V Y Y |
| 101 | D D D D D D |
| 100E | F F F F F F |
| 100D | A Q Q M W Q |
| 100C | L M M T K M |
| 100B | K K K K M Q |
| 100A | R Q N M I R |
| 100 | K W R W R S |
| 99 | A A A A R A |
| 98 | Q H Y G L R |
| 97 | K R K R P K |
| 96 | I N V K K R |
| 95 | Y Y Y Y R Y |
| 94 | R R R R R R |
| 93 | A A A A A A |
| 92 | C C C C C C |

[illegible][illegible]

Figure 23: Sequence analysis of ESL-1 binders

| | Frequency |
|-------|-----------|
| 103 | W |
| 102 | Y |
| 101 | D |
| 100E | - |
| 100D | - |
| 100Ca | - |
| 100C | - |
| 100B | - |
| 100A | - |
| 100 | E |
| 99 | T |
| 98 | F |
| 97 | G |
| 96 | F |
| 95 | G |
| 94 | R |
| 93 | A |
| 92 | C |
| | 4 |
| | 4 |
| | 2 |
| | 1 |
| | 1 |
| | 2 |
| | 1 |
| | 13 |
| | 3 |
| | 1 |
| | 1 |
| | 1 |

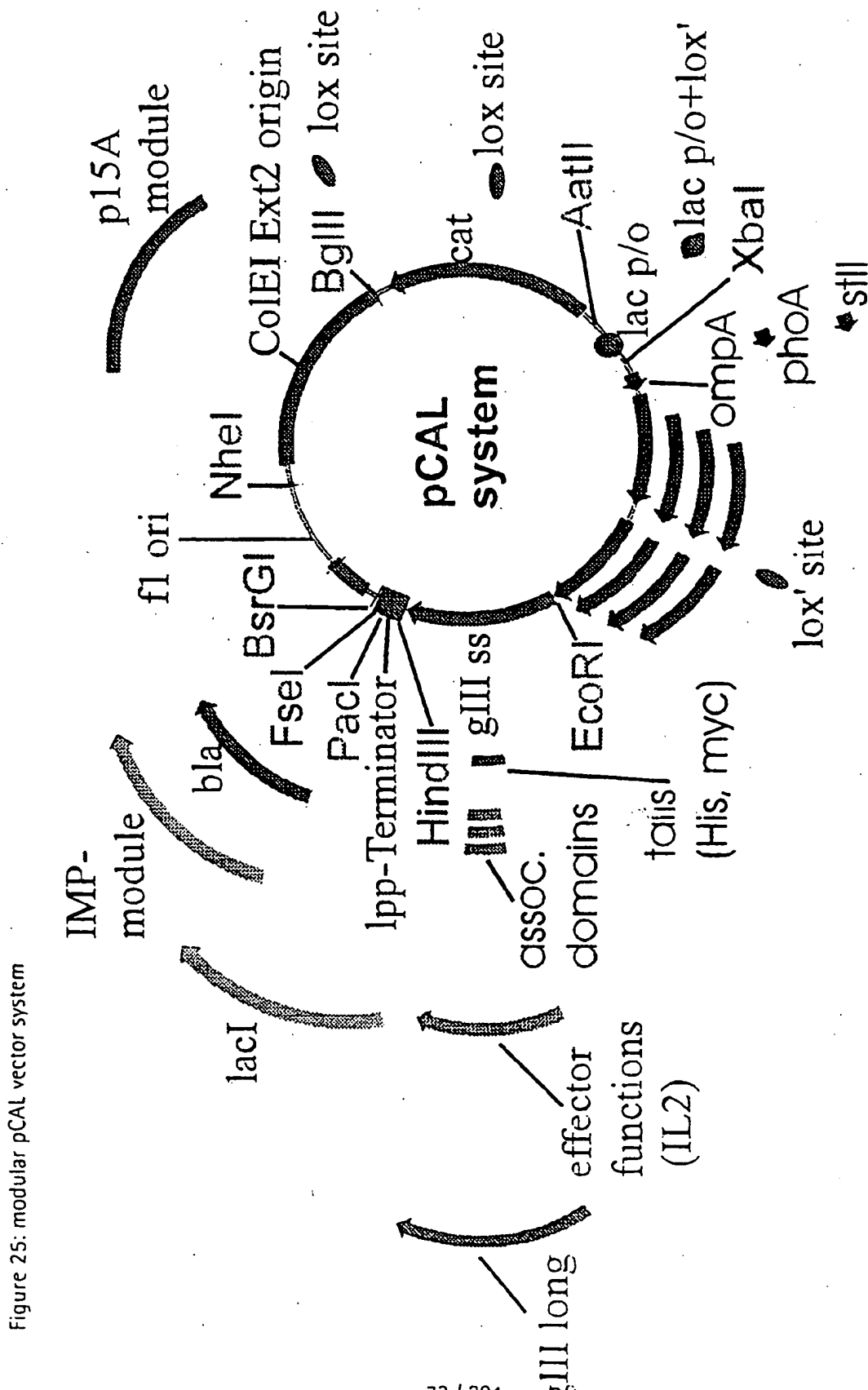


Figure 25: modular pCAL vector system

Figure 25a: List of unique restriction sites used in or suitable for HuCAL genes or pCAL vectors

| unique restriction site | Isoschizomers |
|-------------------------|-----------------------------------|
| AatII | / |
| AfIII | BfrI, BspTI, Bst98I |
| AscI | / |
| Asel | Vspl, AsnI, PshBI |
| BamHI | BstI |
| BbeI | EheI, KasI, NarI |
| BbsI | BpuAI, BpiI |
| BglII | / |
| BlpI | Bpu1102I, CelII, BlpI |
| BsaBI | MamI, Bsh1365I, BsrBRI |
| BsiWI | Pfi23II, SphI, SnuI |
| BspEI | AccIII, BseAI, BsiMI, Kpn2I, MroI |
| BsrGI | Bsp1407I, SspBI |
| BssHII | Paul |
| BstEII | BstPI, Eco91I, Eco065I |
| BstXI | / |
| Bsu36I | AocI, CvnI, Eco81I |
| Drall | / |
| DsmAI | |
| EagI | BstZI, EclXI, Eco52I, XmaIII |
| Eco57I | / |
| EcoO109I | Drall |
| EcoRI | / |
| EcoRV | Eco32I |
| FseI | / |
| HindIII | / |
| HpaI | / |
| KpnI | Acc65I, Asp718I |
| MluI | / |
| MscI | BalI, MluNI |

Figure 25a: List of unique restriction sites used in or suitable for HuCAL genes or pCAL vectors

| unique restriction site | Isoschizomers |
|-------------------------|------------------------------------|
| MunI | MfeI |
| NheI | / |
| NsiI | Ppu10I, EcoT22I, Mph1103I |
| NspV | Bsp119I, BstBI, Csp45I, LspI, SfuI |
| PacI | / |
| PmeI | / |
| PmlI | BbrPI, Eco72I, PmaCI |
| Psp5II | PpuMI |
| PstI | / |
| RsrII | (RsrI), CpoI, CspI |
| SanDI | / |
| SapI | / |
| SexAI | / |
| SpeI | / |
| SfiI | / |
| SphI | BbuI, PaeI, NspI |
| StuI | AatI, Eco147I |
| StyI | Eco130I, EcoT14I |
| XbaI | BspLU11II |
| XhoI | PaeR7I |
| XmaI | AvaI, SmaI, Cfr9I, PspAI |

Figure 26: list of pCAL vector modules

| No | module/flanking restriction sites | functional element | sites to be removed | sites to be inserted | template | reference |
|------|-----------------------------------|---|---------------------|----------------------|---------------|---|
| M1 | AatII-lacp/o-XbaI | lac promoter/operator | 2x VspI (AseI) | AatII | vector pASK30 | Skerra et al. (1991) Bio/Technology 9, 273-278 |
| M2 | BglII-lox-AatII | Cre/lox recombination site | 2x VspI (AseI) | lox, BglII | (synthetic) | Hoess et al. (1986) Nucleic Acids Res. 2287-2300 |
| M3 | XbaI-lox'-SphI | Cre/lox' recombination site | none | lox', SphI | (synthetic) | see M2 |
| M7-I | EcoRI-glllong-HindIII | gllp of filamentous phage with N-terminal myctail/amber codon | SphI, BamHI | none | vector pIG10 | Ge et al., (1994) Expressing antibodies in E. coli. In: Antibody engineering: A practical approach. IRL Press, New York, pp 229-266 |

Figure 26: list of pCAL vector modules

| | | | | | | |
|---------|----------------------|--|----------------------------|-------------------|--------------|----------|
| M7-II | EcoRI-gIIIss-HindIII | truncated gIIIp of filamentous phage with N-terminal Gly-Ser linker | SphI | | vector pIG10 | see M7-I |
| M7-III | EcoRI-gIIIss-HindIII | truncated gIIIp of filamentous phage with N-terminal myctail/amber codon | SphI, BbsI | | vector pIG10 | see M7-I |
| M8 | SphI-lox-HindIII | Cre/lox recombination site | none | lox | (synthetic) | see M3 |
| M9-II | HindIII-lpp-PacI | lpp-terminator | none | PacI, FseI | (synthetic) | see M1 |
| M10-II | PacI/FseI-bla-BsrGI | beta-lactamase/bla (ampR) | VspI, Eco57I, BssSI | PacI, FseI, BsrGI | pASK30 | see M1 |
| M11-II | BsrGI-f1 ori-NheI | origin of single-stranded replication | DrallI (BanII not removed) | BsrGI, NheI | pASK30 | see M1 |
| M11-III | BsrGI-f1 ori-NheI | origin of single-stranded replication | DrallI, BanII | BsrGI, NheI | pASK30 | see M1 |

Figure 26: list of pCAL vector modules

| | | | | | | |
|----------|----------------------|---|----------------------------|------------------|-------------|--|
| M12 | NheI-p15A-BglII | origin of double-stranded replication | BssSI, VspI, NspV | NheI, BglII | pACYC184 | Rose, R.E. (1988) Nucleic Acids Res. 16, 355 |
| M13 | BglII-lox-BglII | Cre/lox recombination site | none | BglII, lox, XmnI | (synthetic) | see M3 |
| M14-Ext2 | BglII-ColEI-NheI | origin of double-stranded replication | Eco57I (BssSI not removed) | BglII, NheI | pUC19 | Yanisch-Peron, C. (1985) Gene 33,103-119 |
| M17 | AatII-cat-BglII | chloramphenicol-acetyltransferase/cat (camR) | BspEI, MscI, StyI/NcoI | | pACYC184 | Cardoso, M. & Schwarz, S. (1992) J. Appl. Bacteriol. 72, 289-293 |
| M19 | XbaI-phoA-EcoRI | signal sequence of phosphatase A | (synthetic) | | (synthetic) | see M1 |
| M20 | XbaI-phoA-FLAG-EcoRI | signal sequence of phosphatase A + FLAG detection tag | (synthetic) | | (synthetic) | Knappik, A & Plückthun, A. (1994) BioTechniques 17, 754-761 |

Figure 26: list of pCAL vector modules

| | | | | | | |
|-----|-----------------------|--|--|--|-------------|---|
| M21 | XbaI-stII-SapI | heat-stable enterotoxin II signal sequence | (synthetic) | | (synthetic) | Lee et al. (1983) Infect. Immunol. 264-268 |
| M41 | AflII-lacI-NheI | lac-repressor | BstXI, MluI, BbsI, BanII, BstEII, HpaI, BbeI, VspI | | pASK30 | see M1 |
| M42 | EcoRI-Histail-HindIII | poly-histidine tail | (synthetic) | | (synthetic) | Lindner et al., (1992) Methods: a companion to methods in enzymology 4, 41-56 |

Figure 27: functional map and sequence of MCS module

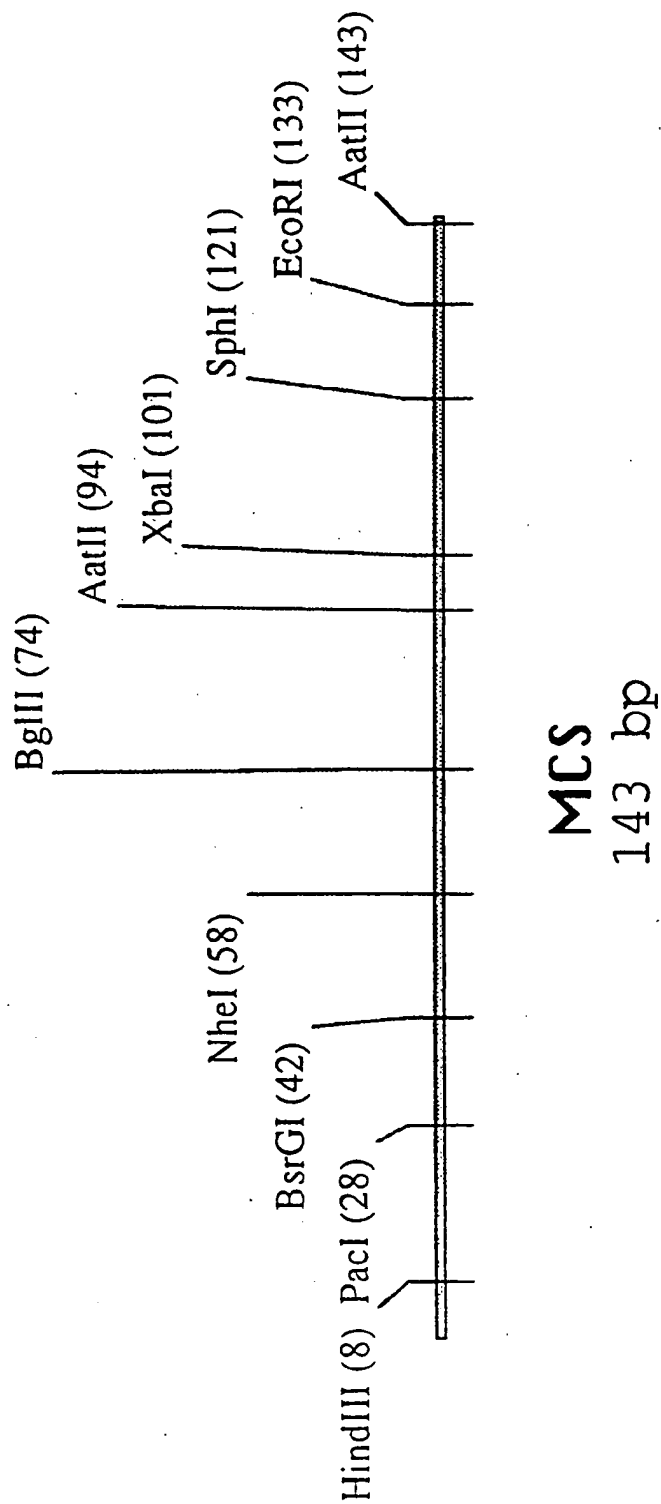


Figure 27: functional map and sequence of MCS module (continued)

| | HindIII | PacI | BsrGI |
|-----|---|-------|-------------|
| | ~~~~~ | ~~~~~ | ~~~~~ |
| 1 | ACATGTAAGC TTCCCCCCCC CCTTAATTAA CCCCCCCCCC TGTACACCCC | | |
| | TGTACATTCTG AAGGGGGGGG GGAATTAATT GGGGGGGGGG ACATGTGGGG | | |
| | | | |
| | NheI | BglII | AatII XbaI |
| | ~~~~~ | ~~~~~ | ~~~~~ |
| 51 | CCCCCGCTA GCCCCCCCCC CCAGATCTCC CCCCCCCCCG GTCCCCCCT | | |
| | GGGGGCGAT CGGGGGGGG GGTCTAGAGG GGGGGGGGCT GCAGGGGGGA | | |
| | | | |
| | XbaI | SphI | EcoRI AatII |
| | ~~~~~ | ~~~~~ | ~~~~~ |
| 101 | CTAGACCCCC CCCCCGCATG CCCCCCCCCC CGAATTCGAC GTC | | |
| | GATCTGGGGG GGGGGCGTAC GGGGGGGGGG GCTTAAGCTG CAG | | |

Figure 28: functional map and sequence of pMCS cloning vector

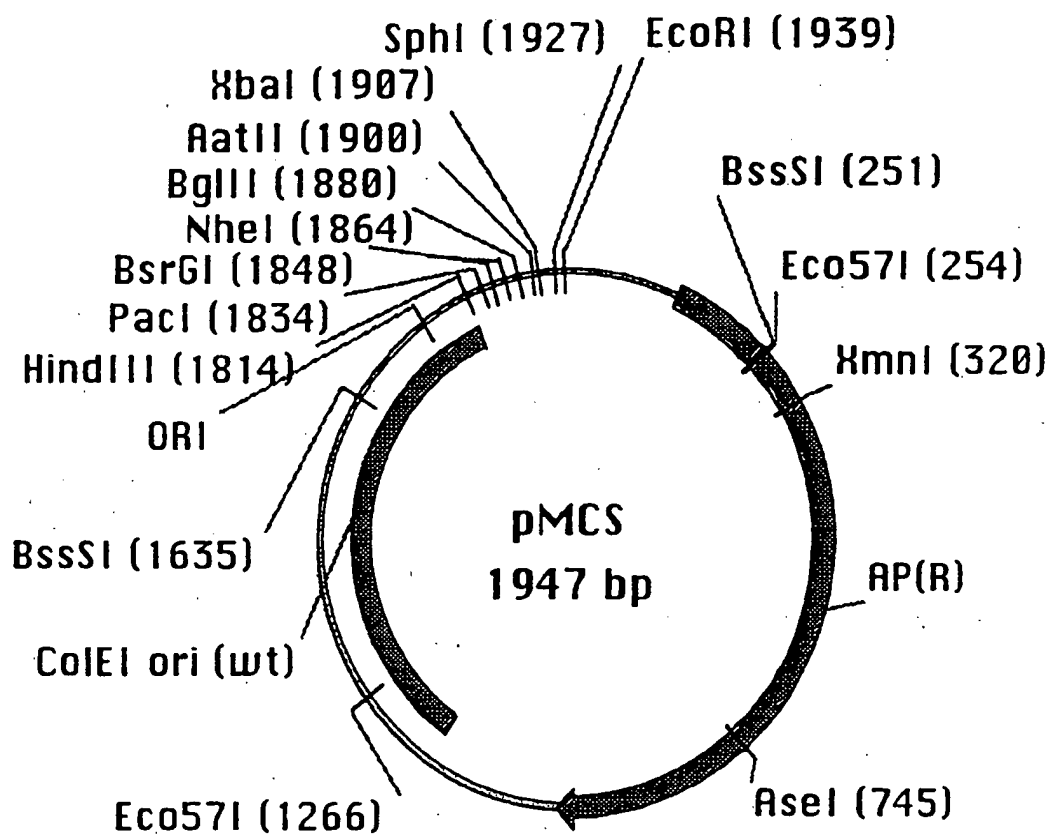


Figure 28: functional map and sequence of pMCS cloning vector (continued)

```

1  CAGGTGGCAC TTTTCGGGGA AATGTGCGCG GAACCCCTAT TTGTTTATTT
   GTCCACCGTG AAAAGCCCCCT TTACACGCGC CTTGGGGATA AACAAATAAA

51  TTCTAAATAC ATTCAAATAT GTATCCGCTC ATGAGACAAT AACCCTGATA
   AAGATTATG TAAGTTTATA CATAGGCGAG TACTCTGTTA TTGGGACTAT

101 AATGCTTCAA TAATATTGAA AAAGGAAGAG TATGAGTATT CAACATTGCC
   TTACGAAGTT ATTATAACTT TTTCCCTTCTC ATACTCATAA GTTGTAAGG

151 GTGTCGCCCT TATCCCTTT TTTGCGGCAT TTTGCCCTTC TGTTTTGTCT
   CACAGCGGGA ATAAGGGAAA AAACGCCGTA AAACGGAAGG ACAAAAACGA

                                     Eco57I
                                     ~~~~~

201 CACCCAGAAA CGCTGGTGAA AGTAAAAGAT GCTGAAGATC AGTTGGGTGC
   GTGGGTCCTT GCGACCACTT TCATTTTCTA CGACTTCTAG TCAACCCACG
                                     BSSI

251 ACGAGTGGGT TACATCGAAC TGGATCTCAA CAGCGGTAAG ATCCTTGAGA
   TGCTCACCCA ATGTAGCTTG ACCTAGAGTT GTCGCCATTC TAGGAAGTCT
   BSSI
   ~~~~~

```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

Xmn I
~~~~~

|     |             |              |             |            |             |
|-----|-------------|--------------|-------------|------------|-------------|
| 301 | GTTTTCGCC   | CGAAGAACGT   | TTTCCAATGA  | TGAGCACTTT | TAAAGTTCTG  |
|     | CAAAAGCGGG  | GCTTCTTGCA   | AAAGTTACT   | ACTCGTGAAA | ATTTCAGAC   |
| 351 | CTATGTGGCG  | CGGTATTATC   | CCGTATTGAC  | GCCGGGCAAG | AGCAACTCGG  |
|     | GATACACCGC  | GCCATAATAG   | GGCATAACTG  | CGCCCCGTTT | TCGTTGAGCC  |
| 401 | TCGCCGCATA  | CACTATTCTC   | AGAAATGACTT | GGTTGAGTAC | TCACCAGTCA  |
|     | AGCGGCGTAT  | GTGATAAGAG   | TCTTACTGAA  | CCAACTCATG | AGTGGTCAGT  |
| 451 | CAGAAAAGCA  | TCTTACGGAT   | GGCATGACAG  | TAAGAGAATT | ATGCAGTGCT  |
|     | GTCCTTTTCGT | AGAAATGCCCTA | CCGTACTGTC  | ATTCTCTTAA | TACGTCACGA  |
| 501 | GCCATAACCA  | TGAGTGATAA   | CACGCGGCC   | AACTTACTTC | TGACAAACGAT |
|     | CGGTATTGGT  | ACTCACTATT   | GTGACGCCCG  | TTGAATGAAG | ACTGTTGCTA  |
| 551 | CGGAGGACCG  | AAGGAGCTAA   | CCGCTTTTTT  | GCACAACATG | GGGATCATG   |
|     | GCCTCCTGGC  | TTCCCTCGATT  | GGCGAAAAAA  | CGTGTTGTAC | CCCCTAGTAC  |
| 601 | TAACTCGCCT  | TGATCGTTGG   | GAACCGGAGC  | TGAATGAAGC | CATACCAAAC  |
|     | ATTGAGCGGA  | ACTAGCAACC   | CTTGCCCTCG  | ACTTACTTCG | GTATGGTTTG  |
| 651 | GACGAGCGTG  | ACACCACGAT   | GCCTGTAGCA  | ATGGCAACAA | CGTTGCGCAA  |

Figure 28: functional map and sequence of pMCS cloning vector (continued)

|      |             |            |             |             |             |
|------|-------------|------------|-------------|-------------|-------------|
|      | CTGCTCGCAC  | TGTGGTGCTA | CGGACATCGT  | TACCGTTGTT  | GCAACGCGTT  |
|      |             |            |             | AseI        |             |
|      |             |            |             | ~~~~~       |             |
| 701  | ACTATTAACT  | GGCGAACTAC | TTACTCTAGC  | TTCCCCGGCAA | CAATTAATAG  |
|      | TGATAAATTGA | CCGCTTGATG | AATGAGATCG  | AAGGGCCGTT  | GTTAATTATC  |
| 751  | ACTGGATGGA  | GGCGGATAAA | GTTGCAGGAC  | CAC TTCTGCG | CTCGGCCCTT  |
|      | TGACCTACCT  | CCGCCATTAT | CAACGTCCCTG | GTGAAGACGC  | GAGCCGGGAA  |
| 801  | CCGGCTGGCT  | GGTTTATTGC | TGATAAATCT  | GGAGCCGGTG  | AGCGTGGGTC  |
|      | GGCCGACCGA  | CCAAATAACG | ACTATTTAGA  | CCTCGGCCAC  | TCGCACCCAG  |
| 851  | TCGCGGTATC  | ATTGCAGCAC | TGGGGCCAGA  | TGGTAAGCCC  | TCCC GTATCG |
|      | AGCGCCATAG  | TAACGTCGTG | ACCCCGGTCT  | ACCATTGCGG  | AGGCGATAGC  |
| 901  | TAGTTATCTA  | CACGACGGGG | AGTCAGGCAA  | CTATGGATGA  | ACGAAATAGA  |
|      | ATCAATAGAT  | GTGCTGCCCC | TCAGTCCGTT  | GATACCTACT  | TGCTTTATCT  |
| 951  | CAGATCGCTG  | AGATAGGTGC | CTCACTGATT  | AAGCATTTGGT | AACTGTCAGA  |
|      | GTCTAGCGAC  | TCTATCCACG | GAGTGACTAA  | TTCGTAACCA  | TTGACAGTCT  |
| 1001 | CCAAGTTTAC  | TCATATATAC | TTTAGATTGA  | TTTAAAACTT  | CATTTTAAAT  |
|      | GGTTCAAATG  | AGTATATATG | AAATCTAACT  | AAATTTTGAA  | GTAAAAATTA  |

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```

1051  TTAAAAGGAT CTAGGTGAAG ATCCTTTTGTG ATAATCTCAT GACCAAAATC
      AATTTTCCCTA GATCCACTTC TAGGAAAAC TATTAGAGTA CTGGTTTAG

1101  CCTTAACGTG AGTTTTCGTT CCACTGAGCG TCAGACCCCG TAGAAAAGAT
      GGAATTGCAC TCAAAAGCAA GGTGACTCGC AGTCTGGGC ATCTTTTCTA

1151  CAAAGGATCT TCTTGAGATC CTTTTTCTT GCGCGTAATC TGCTGCTTGC
      GTTTCCTAGA AGAACTCTAG GAAAAAAGA CCGCATTAG ACGACGAACG

1201  AAACAAAAAA ACCACCGCTA CCAGCGGTGG TTTGTTTGCC GGATCAAGAG
      TTTGTTTTTC TGGTGCGGAT GGTCGCCACC AAACAAACGG CCTAGTTCTC

1251  CTACCAACTC TTTTTCGGAA GGTAACGGC TTCAGCAGAG CGCAGATACC
      GATGGTTGAG AAAAAGGCTT CCATTGACCG AAGTCGTCTC GCGTCTATGG
                                     Eco57I
                                     ~~~~~~

1301 AAATACTGTC CTTCTAGTGT AGCCGTAGTT AGGCCACCAC TTCAAGAACT
 TTTATGACAG GAAGATCACA TCGGCATCAA TCCGGTGGTG AAGTTCTTGA

1351 CTGTAGCACC GCCTACATAC CTCGCTCTGC TAATCCTGTT ACCAGTGGCT
 GACATCGTGG CGGATGTATG GAGCGAGACG ATTAGGACAA TGGTCACCGA

```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```

1401 GCTGCCAGTG GCGATAAGTC GTGTCTTACC GGGTTGGACT CAAGACGATA
 CGACGGTCAC CGCTATTTCAG CACAGAATGG CCCAACCTGA GTTCTGCTAT

1451 GTTACCGGAT AAGGCGCAGC GGTCGGGCTG AACGGGGGGT TCGTGCCACAC
 CAATGGCCCTA TTCCGCGGTCG CCAGCCCGAC TTGCCCCCCC AGCACGTGTG

1501 AGCCCCAGCTT GGAGCGAACG ACCTACACCG AACTGAGATA CCTACAGCGT
 TCGGGTCGAA CCTCGCTTGC TGGATGTGGC TTGACTCTAT GGATGTGCGA

1551 GAGCTATGAG AAAGCGC AC GCTTCCCGAA GGGAGAAAGG CGGACAGGTA
 CTCGATACTC TTTCGCGGTG CGAAGGCTT CCTCTTTCC GCCTGTCCAT

1601 TCCGGTAAGC GGCAGGGTCG GAACAGGAGA GCGCACGAGG GAGCTTCCAG
 AGGCCATTTCG CCGTCCCAGC CTTGTCCCTCT CGCGTGTCTC CTCGAAGGTC
 BssSI
                        ~~~~~

1651  GGGGAAACGC  CTGGTATCTT  TATAGTCCTG  TCGGGTTTCC  CCACCTCTGA
      CCCCTTTGCG  GACCATAGAA  ATATCAGGAC  AGCCCAAAGC  GGTGGAGACT

1701  CTTGAGCGTC  GATTTTGTG  ATGCTCGTCA  GGGGGGCGGA  GCCTATGGAA
      GAACTCGCAG  CTAAAAACAC  TACGAGCAGT  CCCCCCGCCT  CGGATACCTT

1751  AAACGCCAGC  AACGCGGCCT  TTTTACGGTT  CCTGGCCCTT  TGCTGGCCCT

```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

|      |            |            |             |             |            |
|------|------------|------------|-------------|-------------|------------|
|      | TTTGCGGTCG | TTGCGCCGGA | AAATGCCAA   | GGACCGGAA   | ACGACCGGAA |
|      |            | HindIII    |             | PacI        | BsrGI      |
|      |            | ~~~~~      |             | ~~~~~       | ~~~~~      |
| 1801 | TTGCTCACAT | GTAAGCTTCC | CCCCCCCCTT  | AATTAACCC   | CCCCCCTGTA |
|      | AACGAGTGTA | CATTCGAAGG | GGGGGGGAA   | TTAATTGGG   | GGGGGACAT  |
|      |            | NheI       |             | BglII       | AatII      |
|      |            | ~~~~~      |             | ~~~~~       | ~~~~~      |
| 1851 | CACCCCCCCC | CCGCTAGCCC | CCCCCCCCCAG | ATCTCCCCC   | CCCCGACGTC |
|      | GTGGGGGGGG | GGCGATCGGG | GGGGGGGGTC  | TAGAGGGGG   | GGGGCTGCAG |
|      |            | XbaI       |             | SphI        | EcoRI      |
|      |            | ~~~~~      |             | ~~~~~       | ~~~~~      |
| 1901 | CCCCCTCTAG | ACCCCCCCCC | CGCATGCCCC  | CCCCCCCCGAA | TTCACGT    |
|      | GGGGGAGATC | TGGGGGGGGG | GCGTACGGGG  | GGGGGGGCTT  | AAGTGCA    |

Figure 29: functional map and sequence of pCAL module M1

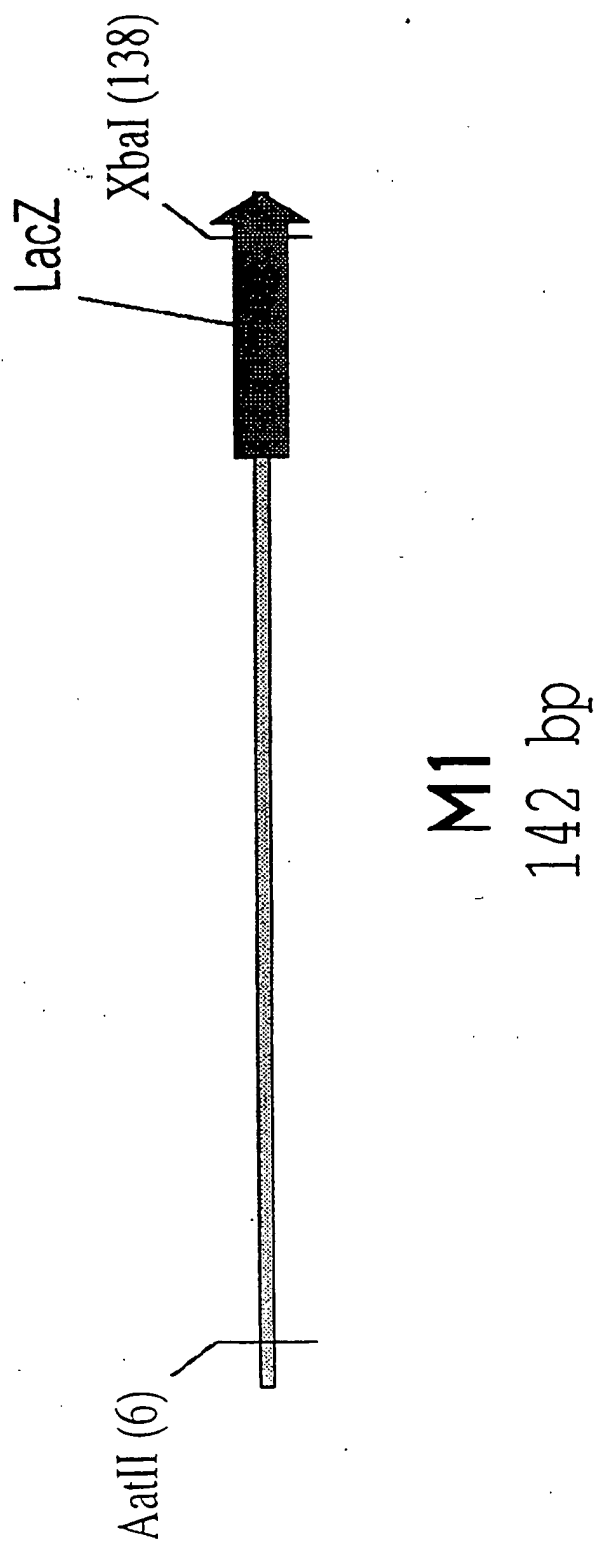


Figure 29: functional map and sequence of pCAL module M1

AatII  
~~~~~  
1 GACGTCTTAA TGTGAGTTAG CTCACTCATT AGGCACCCCA GGCTTTACAC
CTGCAGAATT ACACTCAATC GAGTGAGTAA TCCGTGGGGT CCGAAATGTG

51 TTTATGCTTC CGGCTCGTAT GTTGTGTGGA ATTGTGAGCG GATAACAATT
AAATACGAAG GCCGAGCATA CAACACACCT TAACACTCGC CTATTGTTAA

XbaI
~~~~~  
101 TCACACAGGA AACAGCTATG ACCATGATTA CGAATTCTA GA  
AGTGTGTCCT TTGTCGATAC TGGTACTAAT GCTAAAGAT CT

Figure 30: functional map and sequence of pCAL module M7-II

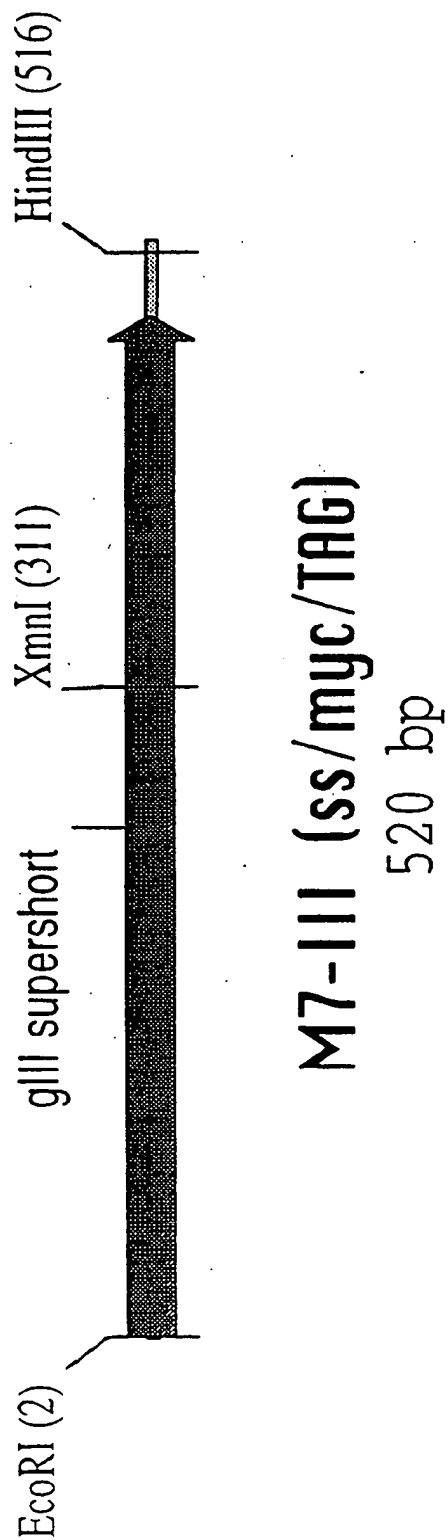


Figure 30: functional map and sequence of pCAL module M7-II (continued)

EcoRI  
 ~~~~~  
 1 GAATTCGAGC AGAAGCTGAT CTCTGAGGAG GATCTGTAGG GTGGTGGCTC
 CTTAAGCTCG TCTTCGACTA GAGACTCCTC CTAGACATCC CACCACCGAG

 51 TGGTTCGGGT GATTTTGATT ATGAAAAGAT GGCAAACGCT AATAAGGGGG
 ACCAAGGCCA CTAAAACTAA TACTTTTCTA CCGTTTGCGA TTATTCCCCC

 101 CTATGACCGA AAATGCCGAT GAAAACGCCG TACAGTCTGA CGCTAAAGGC
 GATACTGGCT TTACGGGCTA CTTTGGCGCG ATGTCAGACT GCGATTTCGG

 151 AAACCTTGATT CTGTCGGCTAC TGATTACGGT GCTGCTATCG ATGGTTTCAT
 TTTGAACTAA GACAGCGATG ACTAATGCCA CGACGATAGC TACCAAAGTA

 201 TGGTGACGTT TCCGGCCTTG CTAATGGTAA TGGTGCTACT GGTGATTTTG
 ACCACTGCAA AGGCCGGAAC GATTACCATT ACCACGATGA CCCTAAAC

 251 CTGGCTCTAA TTCCCAAATG GCTCAAGTCG GTGACGGTGA TAATCACCT
 GACCGAGATT AAGGGTTTAC CGAGTTCAGC CACTGCCACT ATTAAGTGGA

 XmnI
 ~~~~~  
 301 TTAATGAATA ATTTCCGTCA ATATTACCT TCCCTCCCTC AATCGGTGA  
 AATTACTTAT TAAAGGCAGT TATAAATGGA AGGAGGGAG TTAGCCAACT

Figure 30: functional map and sequence of pCAL module M7-II (continued)

```
351  ATGTCGCCCT  TTTGTCTTTG  GCGCTGGTAA  ACCATATGAA  TTTTCTATTG
      TACAGCGGGA  AACAGAAAC  CGCGACCAT  TGGTATACTT  AAAAGATAAC

401  ATTGTGACAA  AATAAACTTA  TTCCGTGGTG  TCTTTGCCGT  TCTTTTATAT
      TAACACTGTT  TTATTGAAT  AAGCACCAC  AGAAACGCAA  AGAAATATA

451  GTTGCCACCT  TTATGTATGT  ATTTCTACG  TTGCTAACA  TACTGCGTAA
      CAACGGTGA  AATACATACA  TAAAGATGC  AAACGATTGT  ATGACGCATT

      HindIII
      ~~~~~
501 TAAGGAGTCT TGATAAGCTT
 ATTCCTCAGA ACTATTTCGAA
```

Figure 31: functional map and sequence of pCAL module M9-II

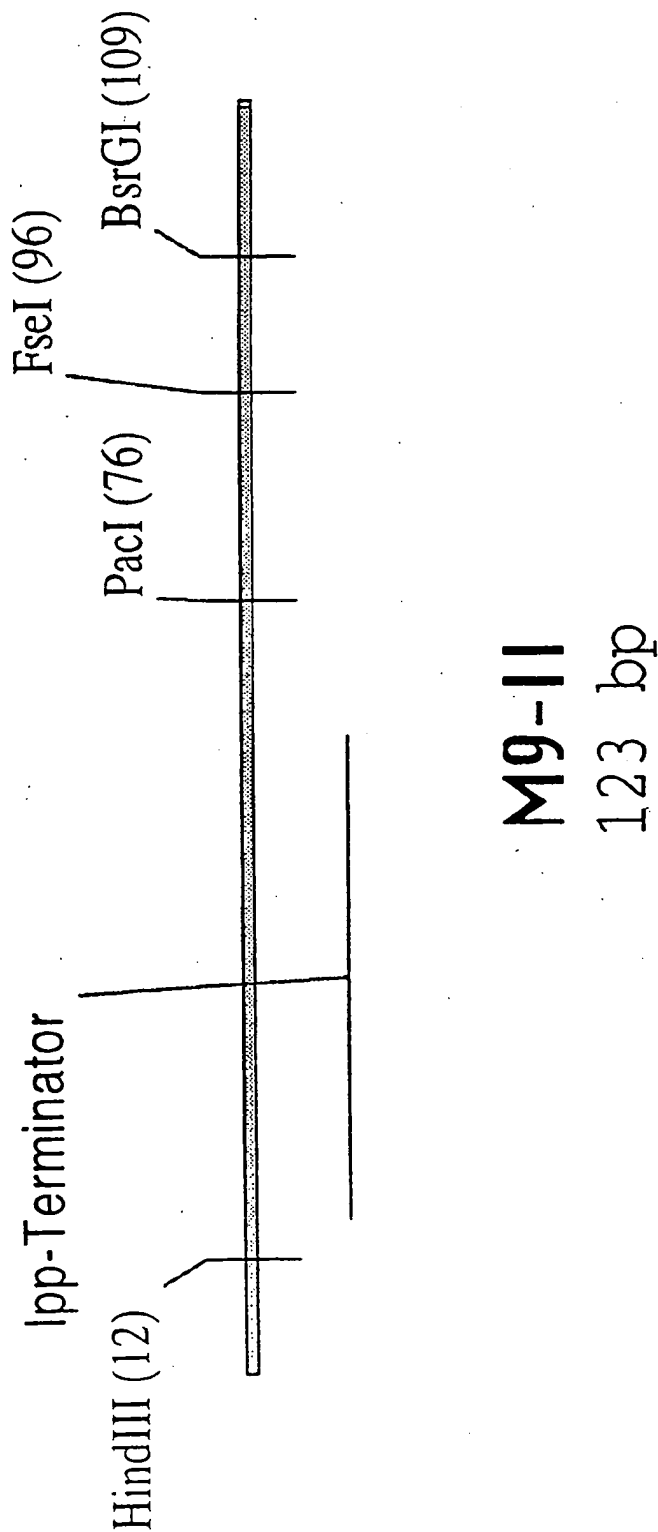


Figure 31: functional map and sequence of pCAL module M9-II (continued)

HindIII  
~~~~~  
1 GGGGGGGGGG AAGCTTGACC TGTGAAGTGA AAAATGGCGC AGATTGTGCG  
CCCCCCCCCC TTCGAACTGG ACACTTCACT TTTTACCGCG TCTAACACGC

PacI  
~~~~~  
51 ACATTTT TTTTGCTGCCGT TTAATTAAAG GGGGGGGGGG GCCGGCCTGG  
TGTAATAAAA ACAGACGGCA AATTAATTTC CCCCCCCCCC CGCCCGGACC

FseI  
~~~~~

BsrGI  
~~~~~  
101 GGGGGGGTGT ACAGGGGGG GGG  
CCCCCCCCCA TGTCCCCCCC CCC

Figure 32: functional map and sequence of pCAL module M11-III

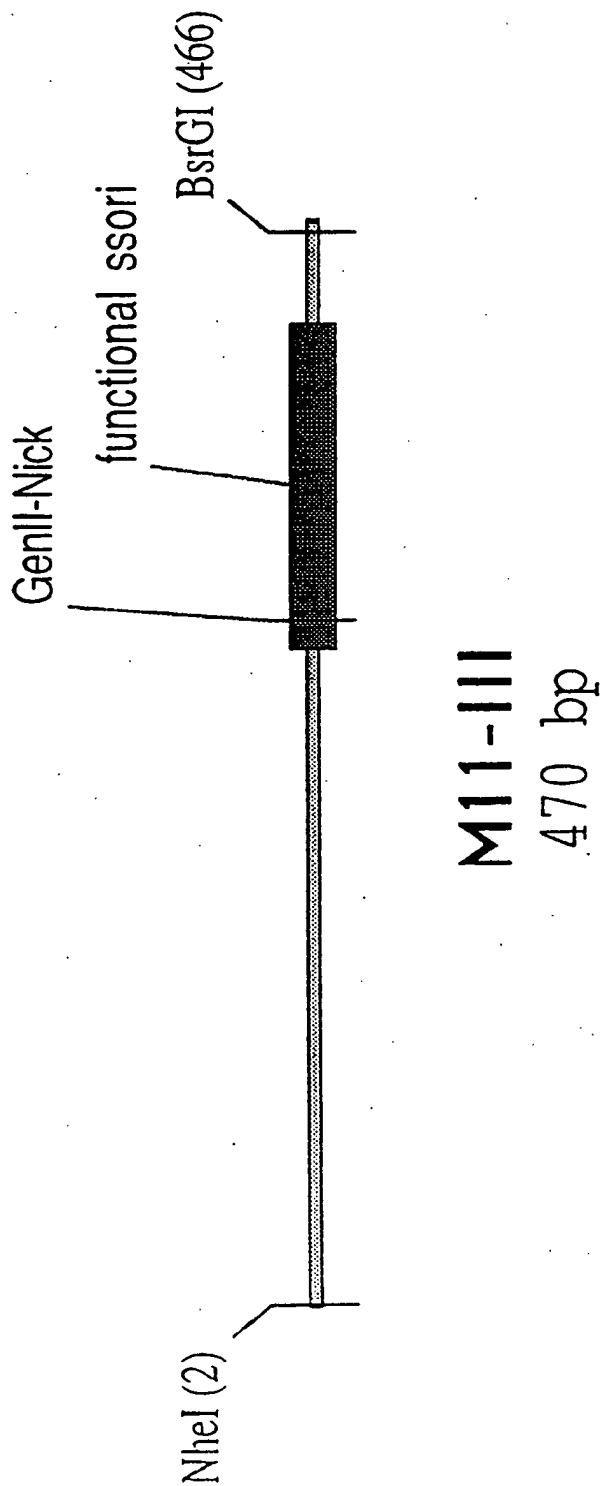


Figure 32: functional map and sequence of pCAL module M11-III (continued)

NheI

~~~~~

|     |            |            |            |            |            |
|-----|------------|------------|------------|------------|------------|
| 1   | GCTAGCACGC | GCCCTGTAGC | GGCGCATTA  | GGCGGCGGG  | TGTGGTGGTT |
|     | CGATCGTGCG | CGGACATCG  | CCGCGTAATT | CGCGCCGCC  | ACACCACCAA |
| 51  | ACGCGCAGCG | TGACCGCTAC | ACTTGCCAGC | GCCCTAGCGC | CCGCTCCTTT |
|     | TGCGCGTCCG | ACTGGCGATG | TGAACGGTCG | CGGATCGCG  | GGCGAGGAAA |
| 101 | CGCTTTCTTC | CCTTCCTTTC | TCGCCACGTT | CGCCGGCTTT | CCCCGTCAAG |
|     | GCGAAAGAAG | GGAAGGAAAG | AGCGGTGCAA | CGCGCCGAAA | GGGCGAGTTC |
| 151 | CTCTAAATCG | GGGCATCCCT | TTAGGGTTCC | GATTTAGTGC | TTTACGGCAC |
|     | GAGATTTAGC | CCCGTAGGGA | AATCCCAAGG | CTAAATCACG | AAATGCCGTG |
| 201 | CTCGACCCCA | AAAACTTGA  | TTAGGGTGAT | GGTTCTCGTA | GTGGGCCATC |
|     | GAGCTGGGGT | TTTTTGA    | AATCCCACTA | CCAAGAGCAT | CACCCGGTAG |
| 251 | GCCCTGATAG | ACGGTTTTC  | GCCCTTTGAC | GTGGAGTCC  | ACGTTCTTTA |
|     | CGGACTATC  | TGCCAAAAG  | CGGAAACTG  | CAACCTCAGG | TGCAAGAAAT |
| 301 | ATAGTGGA   | CTTGTTCCAA | ACTGGAACAA | CACCTAACCC | TATCTCGGTC |
|     | TATCACCTGA | GAACAAGGT  | TGACCTTGTT | GTGAGTTGGG | ATAGAGCCAG |
| 351 | TATTCCTTTG | ATTATAAGG  | GATTTGCCG  | ATTCGGCCT  | ATTGGTTAAA |

Figure 32: functional map and sequence of pCAL module M11-III (continued)

ATAAGAAAAC TAAATATTCC CTAAAACGGC TAAAGCCGGA TAAACCAATTT

401 AAATGAGCTG ATTTAACAAA AATTTAACGC GAATTTTAAC AAAATATTAA  
TTTACTCGAC TAAATTGTTT TTAAATTGCG CTTAAAATTG TTTTATAATT

BsrgI

~~~~~

451 CGTTTACAAT TTCATGTACA  
GCAAAATGTTA AAGTACATGT

Figure 33: functional map and sequence of pCAL module M14-Ext2

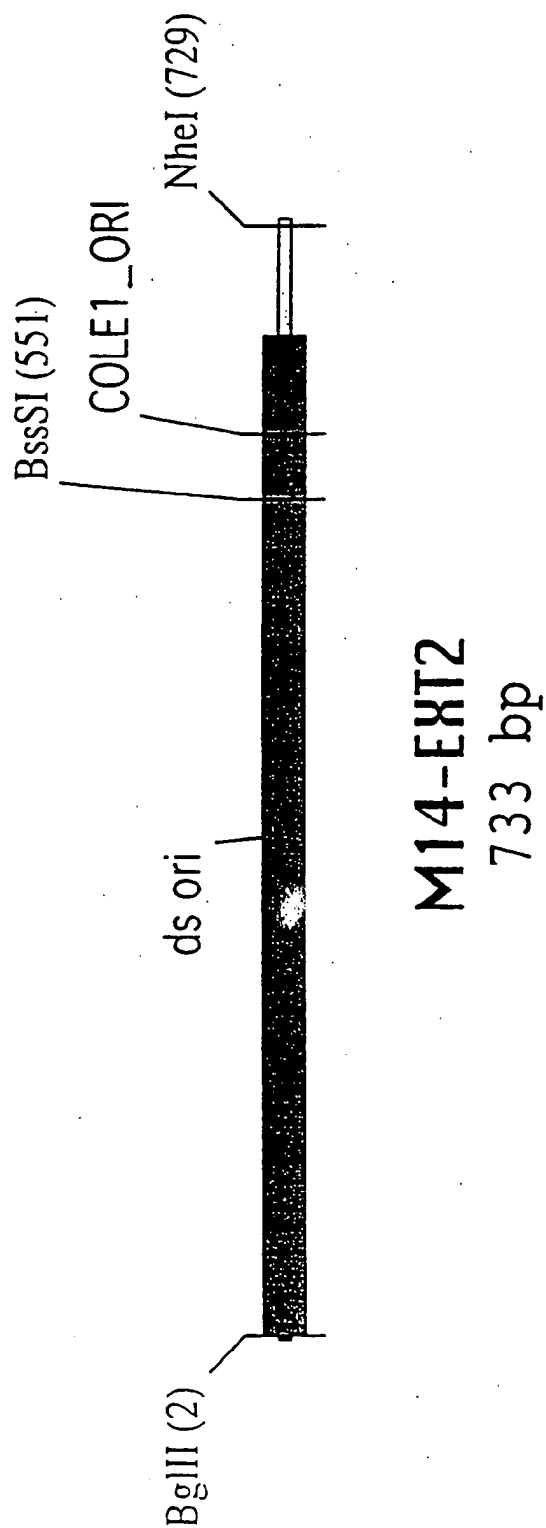


Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

BglII  
~~~~~

|     |             |            |            |             |             |
|-----|-------------|------------|------------|-------------|-------------|
| 1   | AGATCTGACC  | AAAATCCCTT | AACGTGAGTT | TTCGTTCCAC  | TGAGCGTCAG  |
|     | CTAGACTGG   | TTTTAGGGAA | TTGCACTCAA | AAGCAAGGTG  | ACTCGCAGTC  |
| 51  | ACCCCGTAGA  | AAAGATCAAA | GGATCTTCTT | GAGATCCCTT  | TTTTCTGCGC  |
|     | TGGGGCATCT  | TTTCTAGTTT | CCTAGAAGAA | CTCTAGGAAA  | AAAAGACGCG  |
| 101 | GTAATCTGCT  | GCTTGCAAAC | AAAAAACA   | CCGCTACCAG  | CGGTGGTTTG  |
|     | CATTAGACGA  | CGAACGTTTG | TTTTTTTGGT | GGCGATGGTC  | GCCACCAAAC  |
| 151 | TTTGCCGGAT  | CAAGAGCTAC | CAACTCTTTT | TCCGAAGGTA  | ACTGGCTACA  |
|     | AAACGGCCTA  | GTTCTCGATG | GTTGAGAAAA | AGGCTTCCAT  | TGACCGATGT  |
| 201 | GCAGAGCGCA  | GATACCAAAT | ACTGTTCTTC | TAGTGTAGCC  | GTAGTTAGGC  |
|     | CGTCTCGCGT  | CTATGGTTTA | TGACAAGAAG | ATCACATCCG  | CATCAATCCG  |
| 251 | CACCACTTCA  | AGAACTCTGT | AGCACCGCCT | ACATACCCTCG | CTCTGCTAAT  |
|     | GTGGTGAAAGT | TCTTGAGACA | TCGTGGCGGA | TGTATGGAGC  | GAGACGATTA  |
| 301 | CCTGTTACCA  | GTGGCTGCTG | CCAGTGCGCA | TAAGTCGTGT  | CTTACCGGGT  |
|     | GGACAATGGT  | CACCGACGAC | GGTCACCGCT | ATTCAGCACA  | GAATGGCCCCA |
| 351 | TGGACTCAAG  | ACGATAGTTA | CCGGATAAGG | CGCAGCGGTC  | GGGCTGAACG  |

Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

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ACCTGAGTTC TGCTATCAAT GGCCATTCC GCGTCGCCAG CCCGACTTGC
401 GGGGGTTCGT GCACACAGCC CAGCTTGGAG CGAACGACCT ACACCGAACT
CCCCAAGCA CGTGTGTCGG GTCGAACCTC GCTTGCTGGA TGTGGCTTGA

451 GAGATACCTA CAGCGTGAGC TATGAGAAAG CGCCACGCTT CCCGAAGGGA
CTCTATGGAT GTCGCACTCG ATACTCTTTC GCGGTGCGAA GGGCTTCCCT

501 GAAAGGCGGA CAGTATCCG GTAAGCGGCA GGTTCGGAAC AGGAGAGCGC
CTTCCGCCT GTCCATAGGC CATTCGCCGT CCCAGCCTTG TCCTCTCGCG
BssSI

551 ACGAGGGAGC TTCCAGGGGG AAACGCCCTGG TATCTTTATA GTCCGTGTCGG
TGCTCCCTCG AAGTCCCCC TTGCGGACC ATAGAAATAT CAGGACAGCC
BssSI
~~~~~

601 GTTTCGCCAC CTCTGACTTG AGCGTCGATT TTTGTGATGC TCGTCAGGGG
CAAAGCGGTG GAGACTGAAC TCGCAGCTAA AAACACTACG AGCAGTCCCC

651 GGCGGAGCCT ATGGAAAAAC GCCAGCAACG CGGCCCTTTT ACGGTTCCCTG
CCGCCTCGGA TACCTTTTTC CGGTCGTGTC GCCGGAAAAA TGCCAAGGAC

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Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

NheI  
~~~~~  
701 GCCTTTTGCT GGCCTTTTGC TCACATGGCT AGC
CGGAAAACGA CCGGAAAACG AGTGTAACCGA TCG

Figure 34: functional map and sequence of pCAL module M17

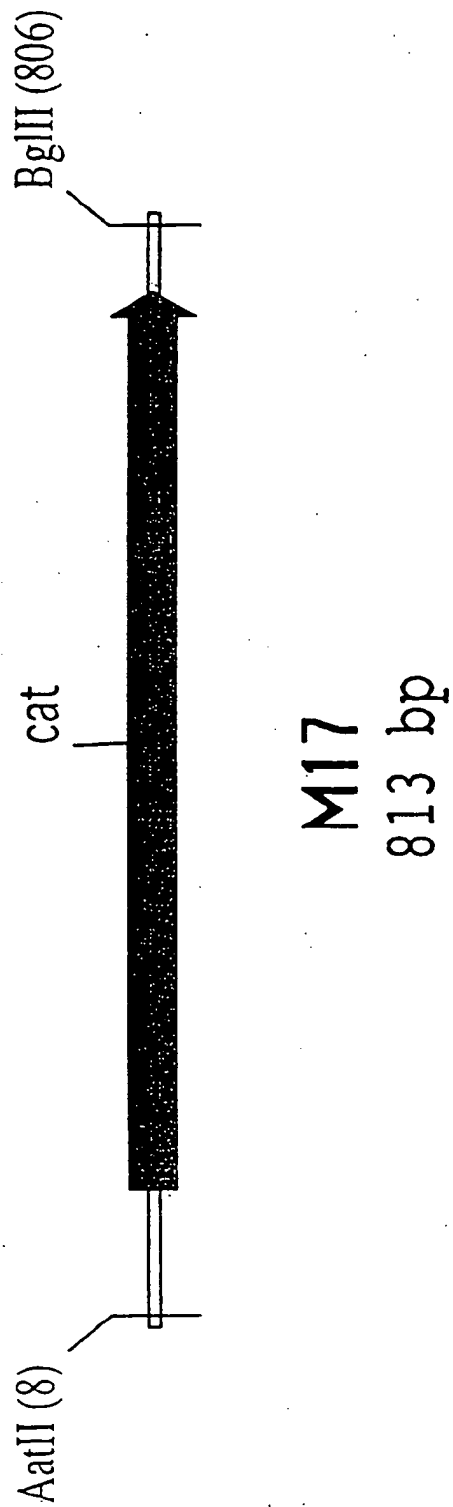


Figure 34: functional map and sequence of pCAL module M17 (continued)

AatII

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1  GGGACGTCGG GTGAGGTTCC AAC TTCACC ATAATGAAAT AAGATCACTA
   CCTGCAGCC CACTCCAAGG TTGAAAGTGG TATTACTTTA TTCTAGTGAT

51  CCGGGCGTAT TTTTGTGATT ATCGAGATT TCAGGAGCTA AGGAAGCTAA
   GGCCCGCATA AAAAAGCTCAA TAGCTCTAAA AGTCCTCGAT TCCTTCGATT

101 AATGGAGAAA AAAATCACTG GATATACCAC CGTTGATATA TCCCAATGGC
   TTACCTCTTT TTTTAGTGAC CTATATGGTG GCAACTATAT AGGTTACCG

151 ATCGTAAAGA ACATTTTGAG GCATTTTCAGT CAGTTGCTCA ATGTACCTAT
   TAGCATTTCT TGTAAGAACTC CGTAAAGTCA GTCACCGAGT TACATGGATA

201 AACCAGACCG TTCAGCTGGA TATTACGGCC TTTTAAAGA CCGTAAAGAA
   TTGGTCTGGC AAGTCGACCT ATAATGCCGG AAAAATTCTT GCATTTCCT

251 AAATAAGCAC AAGTTTATC CGGCCTTTAT TCACATTCTT GCCCGCCTGA
   TTTATTCTGT TTCAAAATAG GCCGAAATA AGTGAAGAA CGGCGGACT

301 TGAATGCTCA CCCGGAGTTC CGTATGGCAA TGAAGACGG TGAGCTGGTG
   ACTTACGAGT GGGCTCAAG GCATACCGTT ACTTCTGCC ACTCGACCAC

351 ATATGGGATA GTGTTACCC TTGTTACACC GTTTCCATG AGCAAACCTGA

```

Figure 34: functional map and sequence of pCAL module M17 (continued)

	TATACCCTAT	CACAAGTGGG	AACAATGTGG	CAAAAGGTAC	TCGTTTGACT
401	AACGTTTTC	TCGCTCTGGA	GTGAATACCA	CGACGATTTC	CGGCAGTTTC
	TTGC AAAAGT	AGCGAGACCT	CACTTATGGT	GCTGCTAAAG	GCCGTCAAAG
451	TACACATATA	TTCGCAAGAT	GTGGCGTGT	ACGGTGAAA	CCTGGCCTAT
	ATGTGTATAT	AAGCGTTCTA	CACCGCACAA	TGCCACTTTT	GGACCGGATA
501	TTCCCTAAAG	GGTTTATTGA	GAATATGTTT	TTCGTCTCAG	CCAATCCCCTG
	AAGGATTTTC	CCAAATAACT	CTTATACAAA	AAGCAGAGTC	GGTAGGGAC
551	GGTGAGTTTC	ACCAGTTTGT	ATTAAACGT	AGCCAATATG	GACAACTTCT
	CCACTCAAAG	TGGTCAAAAC	TAAATTGCA	TCCGGTTATAC	CTGTTGAAGA
601	TCGCCCCCGT	TTTCACTATG	GGCAAATAT	ATACGCAAGG	CGACAAGGTG
	AGCGGGGGCA	AAAGTGATAC	CCGTTTATAA	TATGCGTTCC	GCTGTTCCAC
651	CTGATGCCGC	TGGCGATTCA	GGTTCATCAT	GCCGTTTGTG	ATGGCTTCCA
	GACTACGGCG	ACCGCTAAGT	CCAAGTAGTA	CGCAAACAC	TACCGAAGGT
701	TGTCGGCAGA	ATGCTTAATG	AATTACAACA	GTACTGCCAT	GAGTGGCAGG
	ACAGCCGTCT	TACGAATTAC	TTAATGTTGT	CATGACGCTA	CTCACCGTCC
751	GCGGGGCGTA	ATTTTTTAA	GGCAGTTATT	GGGTGCCCTT	AAACGCCTGG

Figure 34: functional map and sequence of pCAL module M17 (continued)

	CGCCCCCGCAT	TAAAAAATT	CCGTCAATAA	CCCACGGGAA	TTTGCGGACC
		BglII			
		~~~~~			
801	TGCTAGATCT	TCC			
	ACGATCTAGA	AGG			

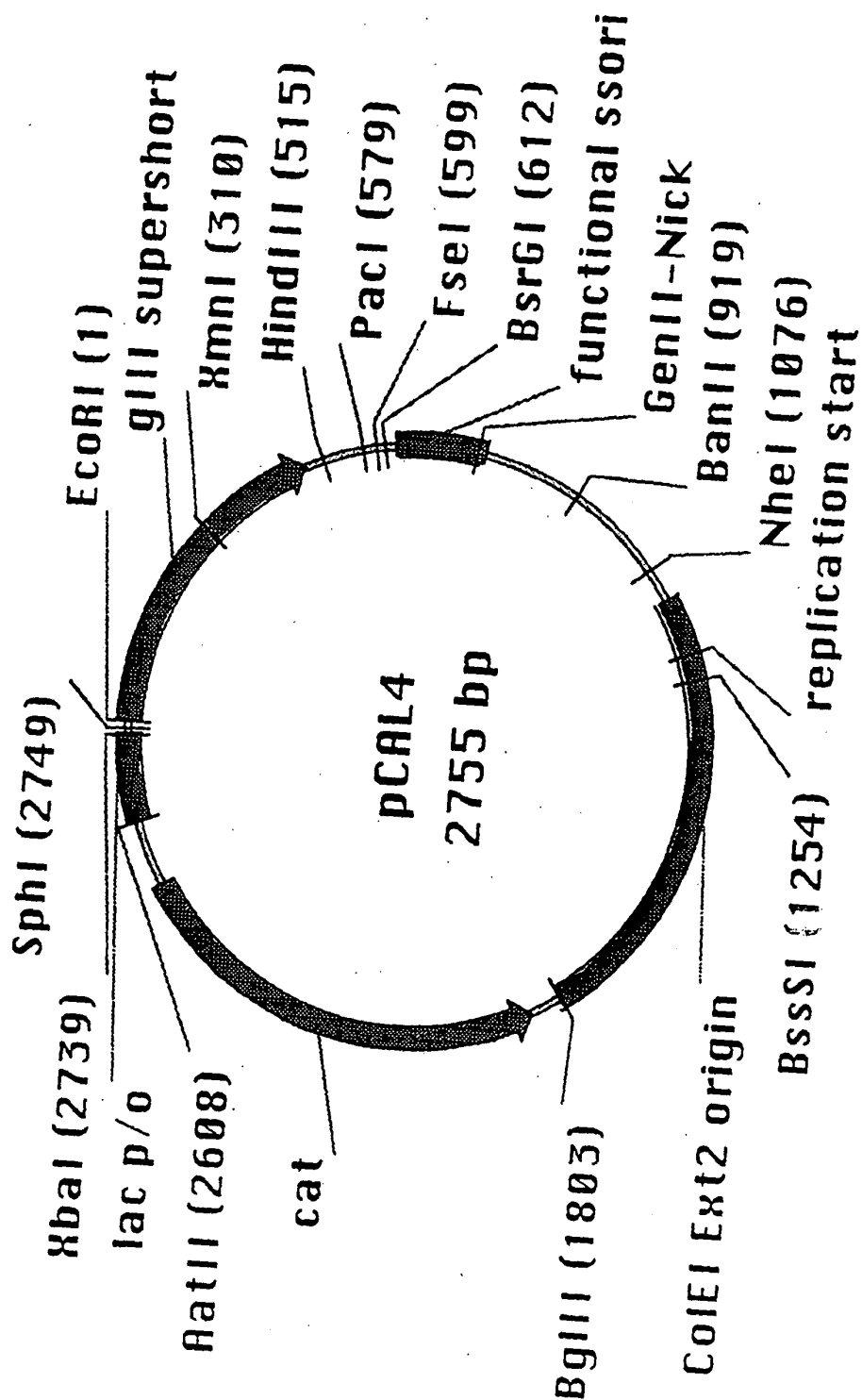


Figure 35: functional map and sequence of modular vector pCAL4

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

## EcoRI

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1  AATTCGAGCA GAAGCTGATC TCTGAGGAGG ATCTGTAGGG TGGTGGCTCT
   TTAAGCTCGT CTTCGACTAG AGACTCCTCC TAGACATCCC ACCACCGAGA

51  GGTTCCGGTG ATTTTGATTA TGAAAAGATG GCAAACGCTA ATAAGGGGGC
   CCAAGGCCAC TAAAACTAAT ACTTTTCTAC CGTTTGGCAT TATCCCCCGG

101 TATGACCGAA AATGCCGATG AAAACGCGCT ACAGTCTGAC GCTAAAGGCA
   ATACTGGCTT TTACGGCTAC TTTTGCGCCA TGTGAGACTG CGATTTCGGT

151 AACTTGATTC TGTCGCTACT GATTACGGTG CTGCTATCGA TGGTTTCATT
   TTGAACTAAG ACAGCGATGA CTAATGCCAC GACGATAGCT ACCAAAAGTAA

201 GGTGACGTTT CCGGCCCTTGC TAATGGTAAT GGTGCTACTG GTGATTTTGC
   CCACTGCAAA GGCCGGAACG ATTACCATTA CCACGATGAC CACTAAAACG

251 TGGCTCTAAT TCCCAAATGG CTCAAGTCGG TGACGGTGAT AATCACCTT
   ACCGAGATTA AGGTTTACC GAGTTCAGCC ACTGCCACTA TTAAGTGGA

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## XmnI

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301 TAATGAATAA TTCCCGTCAA TATTACCTT CCTCCCTCA ATCGGTTGAA
 ATACTTATT AAAGGCAGTT ATAAATGGAA GGGAGGGAGT TAGCCAACTT

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Figure 35: functional map and sequence of modular vector pCAL4 (continued)

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351 TGTCGCCCTT TTGTCTTTGG CGCTGGTAAA CCATATGAAT TTCTATTGA
 ACAGCGGGAA AACAGAAACC GCGACCATTT GTATACTTA AAAGATAACT

401 TTGTGACAAA ATAAACTTAT TCCGTGGTGT CTTTGCGTTT CTTTATATG
 AACACTGTTT TATTGAATA AGGCACCACA GAAACGCAAA GAAAATATAC

451 TTGCCACCTT TATGTATGTA TTTTCTACGT TTGCTAACAT ACTGCGTAAT
 AACGGTGGAA ATACATACAT AAAAGATGCA AACGATTGTA TGACGCATTA

 HindIII
                                ~~~~~

501  AAGGAGTCTT GATAAGCTTG ACCTGTGAAG TGAAAAATGG CGCAGATTGT
    TTCCTCAGAA CTATTCGAAC TGGACACTTC ACTTTTACC GCGTCTAACA

                                PacI
                                ~~~~~

551 GCGACATTTT TTTTGTCTGC CGTTTAATTA AAGGGGGGGG GGGCCGGCC
 CGCTGTAAAA AAACACAGACG GCAAATTAAT TTCCCCCCCC CCGGGCCGG

 BsrGI
                                ~~~~~

601  TGGGGGGGGG TGTACATGAA ATTGTAACCG TTAATATTTT GTTAAAATTC
    ACCCCCCCCC ACATGTACTT TAACATTTCG AATTATAAAA CAATTTTAAG

```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```

651  GCGTTAAATT TTTGTTAAAT CAGTCAATTT TTTAAACCAAT AGGCCGAAAT
    CGCAATTAA AAACAATTAA GTCAGATAA AAATTGGTTA TCCGGCTTTA

701  CGGCAAAATC CCTATAAAT CAAAGAATA GACCGAGATA GGGTTGAGTG
    GCCGTTTATG GGAATATTAA GTTTTCTTAT CTGGCTCTAT CCCAACTCAC

751  TTGTTCCAGT TTGGAACAAG AGTCCACTAT TAAAGAACGT GGACTCCAAC
    AACAAAGTCA AACCTTGTT TCAGGTGATA ATTTCTTGCA CCTGAGGTTG

801  GTCAAAGGCG GAAAAACCGT CTATCAGGC GATGGCCAC TACGAGAACC
    CAGTTTCCCG CTTTTTGGCA GATAGTCCCG CTACCGGGTG ATGCTCTTGG

851  ATCACCCCTAA TCAAGTTT TTGGGTCGAG GTGCCGTAAA GCACTAAATC
    TAGTGGGATT AGTTCAAAAA ACCCCAGCTC CACGGCATTT CGTGATTAG

                                BanII
                                ~~~~~

901 GGAACCCCTAA AGGAGCCCC CGATTAGAG CTTGACGGG AAAGCCGGCG
 CCTTGGGATT TCCCTCGGG GCTAAATCTC GAACTGCCCC TTTCGGCCGC

951 AACGTGGCGA GAAAGGAAG GAAGAAAGCG AAAGAGCGG GCGCTAGGCG
 TTGCACCGCT CTTTCCCTTCC CTTCCTTCGC TTTCCTCGCC CGCGATCCCG

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Figure 35: functional map and sequence of modular vector pCAL4 (continued)

1001	GCTGGCAAGT GTAGCGGTCA CGTGCGCGT AACCAACACA CCGCGCGCGC	
	CGACCGTTCA CATCGCCAGT GCGACGCGCA TTGGTGTGT GGC GCGCGCGC	
		NheI
		~~~~~
1051	TTAATGCGCC GCTACAGGC GCGTGCTAGC CATGTGAGCA AAAGGCCAGC	
	AATTACGCG CGATGTCCCG CGCAGCATCG GTACACTCGT TTTCGGTCCG	
1101	AAAAGGCCAG GAACCGTAA AAGCGCGGT TGCTGGCGTT TTTCATAGG	
	TTTTCGGTC CTTGGCATT TTCCGGCGCA ACGACCGCAA AAAGGTATCC	
1151	CTCCGCCCC CTGACGAGCA TCACAAAAT CGACGCTCAA GTCAGAGGTG	
	GAGCGGGG GACTGCTCGT AGTGTTTTA GCTGCGAGTT CAGTCTCCAC	
1201	GCGAAACCCG ACAGGACTAT AAAGATACCA GCGGTTTCCC CCTGGAAGCT	
	CGCTTTGGC TGTCCTGATA TTTCATATGGT CCGCAAAGGG GGACCTTCGA	
		BssSI
		~~~~~
1251	CCCTCGTGCG CTCTCCTGTT CCGACCCCTGC CGCTTACCGG ATACCTGTCC	
	GGAGCACGC GAGAGGACAA GGCTGGGACG CGGAATGGCC TATGGACAGG	
1301	GCCTTTCTCC CTTCGGGAG CGTGGCGCTT TCTCATAGCT CACGCTGTAG	
	CGGAAAGAGG GAAGCCCTTC GCACCGCGAA AGAGTATCGA GTGCCGACATC	

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

1351	GTATCTCAGT	TCGGTGTAGG	TCGTTTCGCTC	CAAGCTGGGC	TGTGTGCACG
	CATAGAGTCA	AGCCACATCC	AGCAAGCGAG	GTTTCGACCCG	ACACACGTGC
1401	AACCCCCCGT	TCAGCCCCGAC	CGCTGCCGCTT	TATCCGGGTAA	CTATCGTCTT
	TTGGGGGGCA	AGTCGGGCTG	GCGACGCGGA	ATAGGCCATT	GATAGCAGAA
1451	GAGTCCAACC	CGGTAAGACA	CGACTTATCG	CCACTGGCAG	CAGCCACTGG
	CTCAGGTTGG	GCCATTCTGT	GCTGAATAGC	GGTGACCGTC	GTCGGTGACC
1501	TAACAGGATT	AGCAGAGCGA	GGTATGTAGG	CGGTGCTACA	GAGTTCCTGA
	ATTGTCCTAA	TCGTCTCGCT	CCATACATCC	GCCACGATGT	CTCAAGAACT
1551	AGTGGTGGCC	TAACTACGGC	TACACTAGAA	GAACAGTATT	TGGTATCTGC
	TCACCAACCGG	ATTGATGCCG	ATGTGATCTT	CTTGTCATAA	ACCATAGACG
1601	GCTCTGCTGT	AGCCAGTTAC	CTTCGGAAAA	AGAGTTGGTA	GCTCTTGATC
	CGAGACGACA	TCGGTCAATG	GAAGCCTTTT	TCTCAACCAT	CGAGAACTAG
1651	CGGCAAAACAA	ACCACCGCTG	GTAGCGGTGG	TTTTTTTGTG	TGCAAGCAGC
	GCCGTTTGTT	TGGTGGCGAC	CATCGCCACC	AAAAAAACAA	ACGTTCTGTC
1701	AGATTACGCG	CAGAAAAAAA	GGATCTCAAG	AAGATCCTTT	GATCTTTTCT
	TCTAATGCGC	GTCTTTTTTT	CCTAGAGTTC	TTCTAGGAAA	CTAGAAAAAG

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

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1751 ACGGGGTCTG ACGCTCAGTG GAACGAAAC TCACGTTAAG GGATTTGGT
 TGCCCCAGAC TCGGAGTCAC CTGCTTTTG AGTGCAATTC CCTAAACCA

 BglII
      ~~~~~
1801  CAGATCTAGC  ACCAGGCGTT  TAAGGCACC  AATAACTGCC  TTAAAAAAT
      GTCTAGATCG  TGGTCCGCAA  ATTCCCGTGG  TTATTGACGG  AATTTTTTA

1851  TACGCCCCGC  CCTGCCACTC  ATCGCAGTAC  TGTGTGAATT  CATTAAGCAT
      ATGCGGGGCG  GGACGGTGAG  TAGCGTCATG  ACAACATTAA  GTAATTCCGTA

1901  TCTGCCGACA  TGGAAGCCAT  CACAAACGGC  ATGATGAACC  TGAATCGCCA
      AGACGGCTGT  ACCTTCGGTA  GTGTTTGCCG  TACTACTTGG  ACTTAGCGGT

1951  GCGGCATCAG  CACCTTGTCG  CCTGCGGTAT  AATATTTGCC  CATAGTGAAA
      CGCCGTAGTC  GTGGAACAGC  GGAACGCATA  TTATAAACGG  GTATCACTTT

2001  ACGGGGGCGA  AGAAGTTGTC  CATATTGGCT  ACGTTTAAAT  CAAAACTGGT
      TGCCCCCGCT  TCTTCAACAG  GTATAACCGA  TGCAAAATTA  GTTTTGACCA

2051  GAAACTCACC  CAGGGATTGG  CTGAGACGAA  AAACATATTC  TCAATAAAC
      CTTTGAGTGG  GTCCCTAACC  GACTCTGCTT  TTTGTATAAG  AGTTATTGG

```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

2101	CTTTAGGGAA ATAGGCCAGG TTTTCACCGT AACACGCCAC ATCTTGCGGAA	TATCGGTCG TGGTATTCAC TCCAGAGCGA
	GAAATCCCTT TATCCGGTCC AAAAGTGGCA TTGTGCCGTG TAGAACGCTT	AGGTCTCGCT
2151	TATATGTGTA GAAACTGCCG GAAATCGTCG	ACCATAAGTG
	ATATACACAT CTTTGACGGC CTTTAGCAGC	AGGTCTCGCT
2201	TGAAAACGTT TCAGTTTGCT CATGGAAAAC GGTGTAACAA GGTGAACAC	CCACATTGTT
	ACTTTTGCAA AGTCAAACGA GTACCTTTTG	CCCACATTGTG
2251	TATCCCATAT CACCAGCTCA CCGTCTTTCA TTGCCATACG GAAC TCCGGG	CTTGAGGCCCC
	ATAGGGTATA GTGGTCGAGT GGCAGAAAGT AACGGTATGC	
2301	TGAGCATTCA TCAGCGGGC AAGAATGTGA ATAAAGGCCG GATAAACTT	CTATTTTGAA
	ACTCGTAAAGT AGTCCGCCCG TTCTTACACT	
2351	GTGCTTATTT TTCTTTACGG TCTTTAAAAA GGCCGTAATA TCCAGCTGAA	AGTCCGACTT
	CACGAATAAA AAGAAATGCC AGAAATTTT	
2401	CGGTCTGGTT ATAGGTACAT TGAGCAACTG ACTGAAATGC CTCAAAATGT	GAGTTTACAC
	GCCAGACCAA TATCCATGTA ACTCGTTGAC	
2451	TCTTTACGAT GCCATTGGGA TATATCAACG GTGGTATATC CAGTGATTTT	GTCACATAAA
	AGAAATGCTA CGGTAAACCCT ATATAGTTGC	

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

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2501  TTTCTCCATT TTAGCTTCCT TAGCTCCTGA  AAATCTCGAT  AACTCAAAAA
      AAAGAGGTAA AATCGAAGGA ATCGAGGACT  TTTAGAGCTA  TTGAGTTT
2551  ATACGCCCGG  TAGTGATCTT  ATTTCAATTAT  GGTGAAAGTT  GGAACCTCAC
      TATGCCGGCC  ATCACTAGAA  TAAAGTAATA  CCACTTTCAA  CCTGGAGTG

      AatII
      ~~~~~
2601 CCGACGTCTA ATGTGAGTTA GCTCACTCAT TAGGCACCCC AGGCTTTACA
 GGCTGCAGAT TACACTCAAT CGAGTGAGTA ATCCGTGGGG TCCGAAATGT
2651 CTTTATGCTT CCGGCTCGTA TGTGTGTGG AATTGTGAGC GGATAACAAT
 GAAATACGAA GGCCGAGCAT ACAACACACC TTAACACTCG CCTATTGTTA

 XbaI SphI
      ~~~~~
2701  TTCACACAGG  AAACAGCTAT  GACCATGATT  ACGAATTCT  AGAGCATGCG
      AAGTGTGTCC  TTTGTGCGATA  CTGGTACTAA  TGCTTAAAGA  TCTCGTACGC

      EcoRI

2751  GGGG
      CCCC

```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors

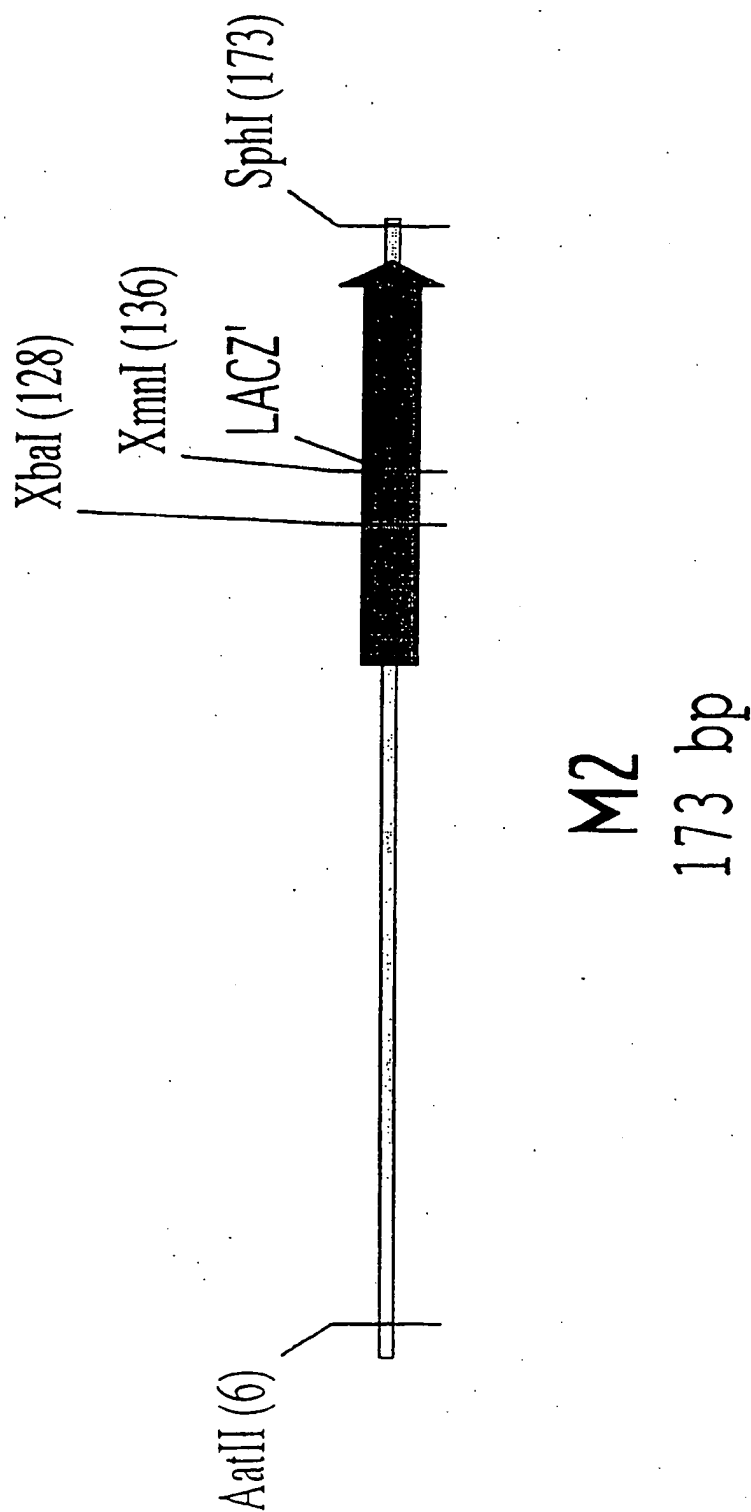


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 2:

AatII

~~~~~

1 GACGTCTTAA TGTGAGTTAG CTCACTCATT AGGCACCCCA GGCTTTACAC
CTGCAGAATT ACACTCAATC GAGTGAGTAA TCCGTGGGT CCGAAATGTG

51 TTTATGCTTC CGGCTCGTAT GTTGTGTGGA ATTGTGAGCG GATAACAATT
AAATACGAAG GCCGAGCATA CAACACACCT TAACACTCGC CTATTGTTAA

XmnI

~~~~~

XbaI

~~~~~

101 TCACACAGGA AACAGCTATG ACCATGTCTA GAATAACTTC GTATAATGTA
AGTGTGTCCT TTGTCGATAC TGGTACAGAT CTTATTGAAG CATATTACAT

SphI

~~~~~

151 CGCTATACGA AGTATCGCA TGC  
GCGATATGCT TCAATAGCGT ACG

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

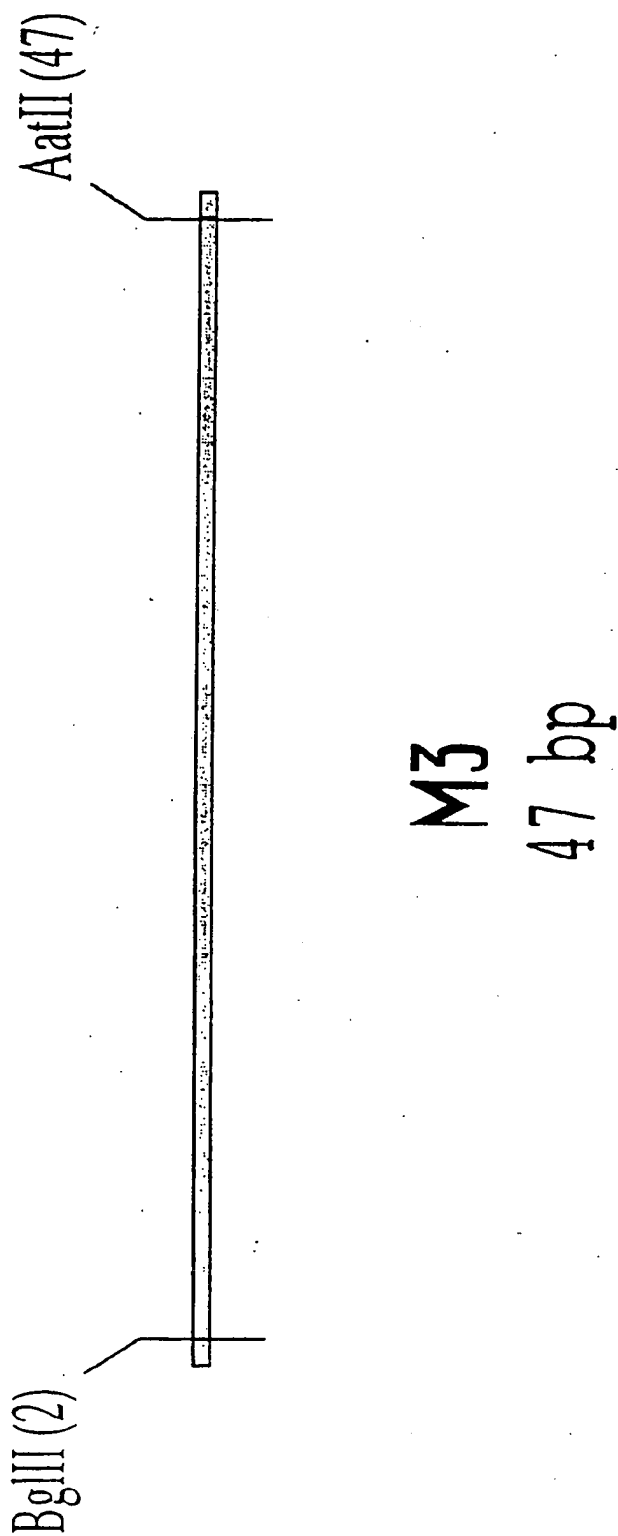


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 3:

	BglII	AatII
	-----	-----
1	AGATCTCATA ACTTCGTATA ATGTATGCTA TACGAAGTTA TGACGTC	
	TCTAGAGTAT TGAAGCATAT TACATACGAT ATGCTTCAAT ACTGCAG	

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

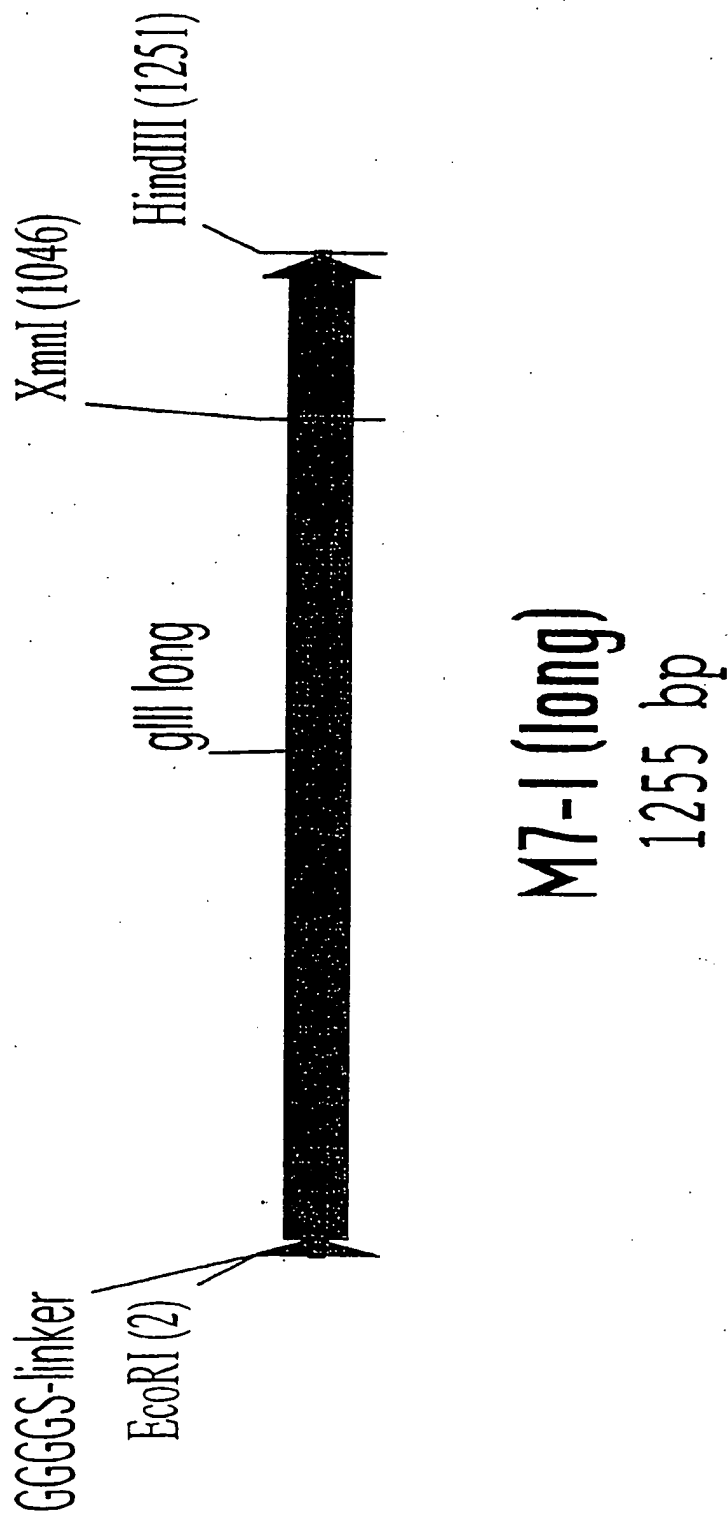


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

## M 7-I (long):

## ECORI

-----

1	GAATTCGGTG	GTGGTGGATC	TGCGTGCGCT	GAAACGGTTG	AAAGTTGTTT
	CTTAAGCCAC	CACCACCTAG	ACGCACGCCA	CTTTGCCAAC	TTTCAACAAA
51	AGCAAAATCC	CATACAGAAA	ATTCATTTAC	TAACGCTCTGG	AAAGACGACA
	TCGTTTTAGG	GTATGTCTTT	TAAGTAAATG	ATTGCAGACC	TTTCTGCTGT
101	AAACTTTAGA	TCGTTACGCT	AACTATGAGG	GCTGTCTGTG	GAATGCTACA
	TTTGAAATCT	AGCAATGCCA	TTGATACTCC	CGACAGACAC	CTTACGATGT
151	GGCGTTGTAG	TTTGTA CTGG	TGACGAAACT	CAGTGTTACG	GTACATGGGT
	CCGCAACATC	AAACATGACC	ACTGCTTTGA	GTCACAATGC	CATGTACCCA
201	TCCTATTGGG	CTTGCTATCC	CTGAAAATGA	GGGTGGTGCC	TCTGAGGGTG
	AGGATAACCC	GAACGATAGG	GACTTTTACT	CCCACCCACG	AGACTCCCAC
251	GCGGTTCTGA	GGGTGGCGGT	TCTGAGGGTG	GCGGTACTAA	ACCTCCTGAG
	CGCCAAGACT	CCCACCGCCA	AGACTCCCCAC	CGCCATGATT	TGGAGGACTC
301	TACGGTGATA	CACCTATTCC	GGGCTATACT	TATATCAACC	CTCTCGACGG
	ATGCCACTAT	GTGGATAAGG	CCCGATATGA	ATATAGTTGG	GAGAGCTGCC

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

351	CACTATACCG CCTGGTACTG AGCAAAACCC CGCTAATCCT AATCCTTCTC GTGAATAGGC GGACCATGAC TCGTTTGGG GCGATTAGGA TTAGGAAGAG
401	TTGAGGAGTC TCAGCCTCTT AATACTTTCA TGTTTCAGAA TAATAGGTTC AACTCCTCAG AGTCGGAGAA TTATGAAAGT ACAAAGTCTT ATTATCCAAG
451	CGAAATAGGC AGGGGCGATT AACTGTTTAT ACGGGCACTG TTAACAAGG GCTTTATCCG TCCCCCGTAA TTGACAAATA TGCCCCGTGAC AATGAGTTCC
501	CACTGACCCC GTTAAACTT ATTACCAGTA CACTCCTGTA TCATCAAAAG GTGACTGGGG CAATTTTGAA TAATGGTCAT GTGAGGACAT AGTAGTTTC
551	CCATGTATGA CGCTTACTGG AACGGTAAAT TCAGAGACTG CGCTTTCCAT GGTACATACT GCGAATGACC TTGCCATTTA AGTCTCTGAC GCGAAAGGTA
601	TCTGGCTTTA ATGAGGATTT ATTTGTTTGT GAATATCAAG GCCAATCGTC AGACCGAAAT TACTCCTAAA TAAACAAACA CTTATAGTTC CGGTTAGCAG
651	TGACCTGCCT CAACCTCCTG TCAATGCTGG CGGCGGCTCT GTGGTGGTT ACTGGACGGA GTTGAGGAC AGTTACGACC GCCGCCGAGA CCACCACCAA
701	CTGGTGGCGG CTCTGAGGGT GTGGGCTCTG AGGGTGCGCG TTCTGAGGGT GACCACCGCC GAGACTCCCA CCACCGAGAC TCCCACCGCC AAGACTCCCA

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

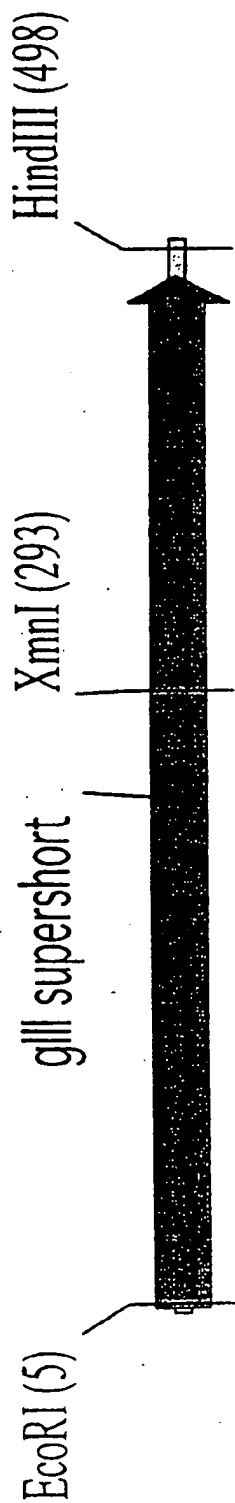
751	GGCGGCTCTG	AGGAGGGCGG	TTCCGGTGGT	GGCTCTGGTT	CCGGTGATTT
	CCGCCGAGAC	TCCCTCCGCC	AAGGCCACCA	CCGAGACCAA	GGCCACTAAA
801	TGATTATGAA	AAGATGGCAA	ACGCTAAATA	GGGGGCTATG	ACCGAAAATG
	ACTAATACTT	TTCTACCGTT	TGCGATTATT	CCCCCGATAC	TGGCTTTTAC
851	CCGATGAAAA	CGCGCTCAG	TCTGACGCTA	AAGGCAAACT	TGATTCTGTC
	GGCTACTTTT	CGCGATGTC	AGACTGCCGAT	TTCCGTTTGA	ACTAAGACAG
901	GCTACTGATT	ACGGTGCTGC	TATCGATGGT	TTCATTGGTG	ACGTTTCCGG
	CGATGACTAA	TGCCACGACG	ATAGCTACCA	AAGTAACCAC	TGCAAAGGCC
951	CCTTGCTAAT	GGTAATGGTG	CTACTGGTGA	TTTTTGCTGGC	TCTAATTCCC
	GGAACGATTA	CCATTACCAC	GATGACCACT	AAAACGACCG	AGATTAAAGG
XmnI					
1001	AAATGGCTCA	AGTCGGTGAA	GGTGATAATT	CACCTTTAAT	GAATAATTTC
	TTTACCGAGT	TCAGCCACTT	CCACTATTAA	GTGGAAATTA	CTTATTAAAG
1051	CGTCAATATT	TACCTTCCAT	CCCTCAATCG	GTTGAATGTC	GCCCTTTTGT
	GCAGTTATAA	ATGGAAGGTA	GGGAGTAGC	CAACTTACAG	CGGGAACAAC

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

1101	CTTTGGCGCT	GGTAAACCCCT	ATGAATTTC	TATTGATTGT	GACAAAATAA
	GAAACCGCGA	CCATTGGGA	TACTTAAAG	ATAACTAACA	CTGTTTATT
1151	ACTTATCCG	TGGTGTC	GCGTTCTTT	TATATGTTGC	CACCTTTATG
	TGAATAAGC	ACCACAGAA	CGCAAAGAA	ATATACAACG	GTGGAAATAC
					HindIII
1201	TATGTATTT	CTACGTTTC	TAACTACTG	CGTAATAAGG	AGTCTTGATA
	ATACATAAAA	GATGCAAACG	ATTGTATGAC	GCATTATTCC	TCAGAACTAT
					HindI
					~~~~
1251		AGCTT			
		TCGAA			

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Figure 35a: Functional maps and sequences of additional: pCAL vector modules and pCAL vectors (continued)



M7-II (SS-TAG)

502 bp

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 7-II (ss-TAG) :

ECORI

1	CGGGAATTCTG	GAGCGGTTC	CGGTGGTGGC	TCTGGTTCCG	GTGATTTTGA
	GCCCTTAAGC	CTCCGCCAAG	GCCACCACCG	AGACCAAGGC	CACTAAAACT
51	TTATGAAAAG	ATGGCAAACG	CTAATAAGGG	GGCTATGACC	GAAAATGCCG
	AATACTTTC	TACCGTTTGC	GATTATTCCC	CCGATACTGG	CTTTTACGGC
101	ATGAAAACGC	GCTACAGTCT	GACGCTAAAG	GCAAACCTGA	TTCTGTGCGT
	TACTTTTGCG	CGATGTCAGA	CTGCGATTTC	CGTTTGAAC	AAGACAGCGA
151	ACTGATTACG	GTGCTGCTAT	CGATGGTTTC	ATTGGTGACG	TTTCCGGCCT
	TGACTAATGC	CACGACGATA	GCTACCACAAG	TAACCACTGC	AAAGGCCCGA
201	TGCTAATGGT	AATGGTGCTA	CTGGTGATT	TGCTGGCTCT	AATCCCATAA
	ACGATTACCA	TTACCACGAT	GACCACTAAA	ACGACCGAGA	TTAAGGGTTT
251	TGGCTCAAGT	CGGTGACGGT	GATAATTCAC	CTTTAATGAA	TAATTCCGT
	ACCGAGTTCA	GCCACTGCCA	CTATTAAAGTG	GAAATTACTT	ATTAAAGGCA

XmnI

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

301	CAATATTAC CTTCCCTCCC TCAATCGGTT GAATGTCGCC CTTTGTCTT	CTTTGTCTT
	GTTATAAATG GAAGGGAGGG AGTTAGCCAA CTTACAGCGG GAAACAGAA	GAAACAGAA
351	TGGCGCTGGT AAACCATATG AATTTCTAT TGATTGTGAC AAAATAAACT	AAAATAAACT
	ACCGGACCA TTTGGTATAC TTAAAAGATA ACTAACACTG TTTTATTGA	TTTTATTGA
401	TATCCGTGG TGTCTTTCG TTTCTTTTAT ATGTTGCCAC CTTTATGTAT	CTTTATGTAT
	ATAAGGCACC ACAGAAACGC AAAGAAAATA TACAACGGTG GAAATACATA	GAAATACATA
		HindIII
451	GTATTTCTA CGTTGCTAA CATACTGCCG AATAAGGAGT CTTGATAAGC	CTTGATAAGC
	CATAAAAGAT GCAAACGATT GTATGACGCA TTATTCCTCA GAACATATCG	GAACATATCG
501	Hi	----
	~	
	TT	
	AA	

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

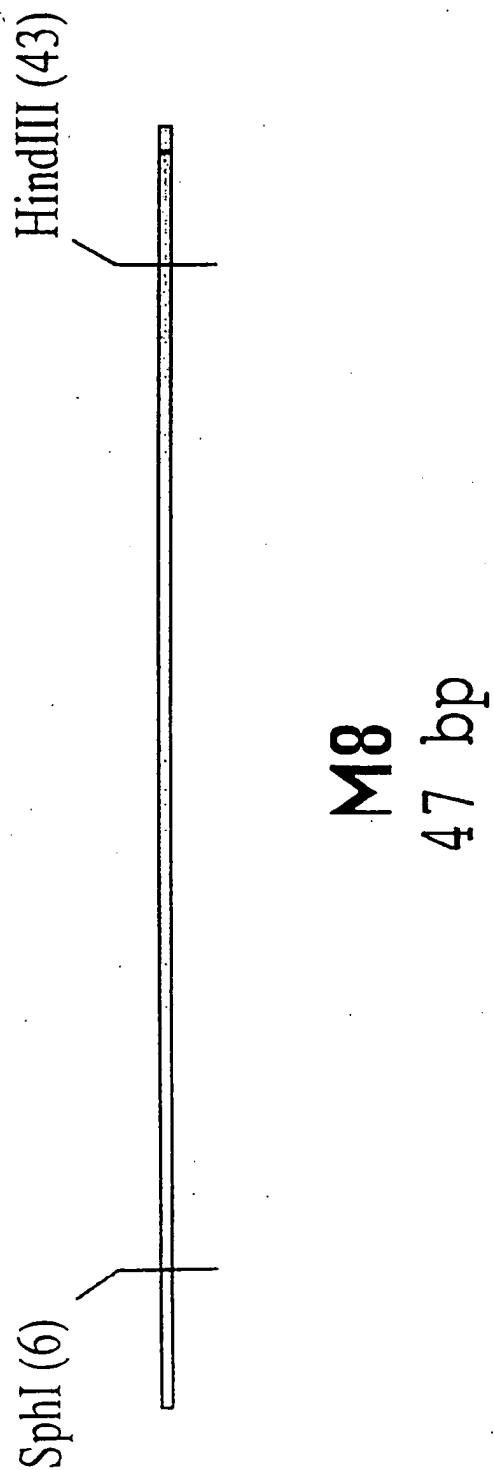


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 8:

	SphI		HindIII
	~~~~~		~~~~~
1	GCATGCCATA ACTTCGTATA ATGTACGCTA TACGAAGTTA TAAGCTT		
	CGTACGGTAT TGAAGCATAT TACATGCGAT ATGCTTCAAT ATTCGAA		

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

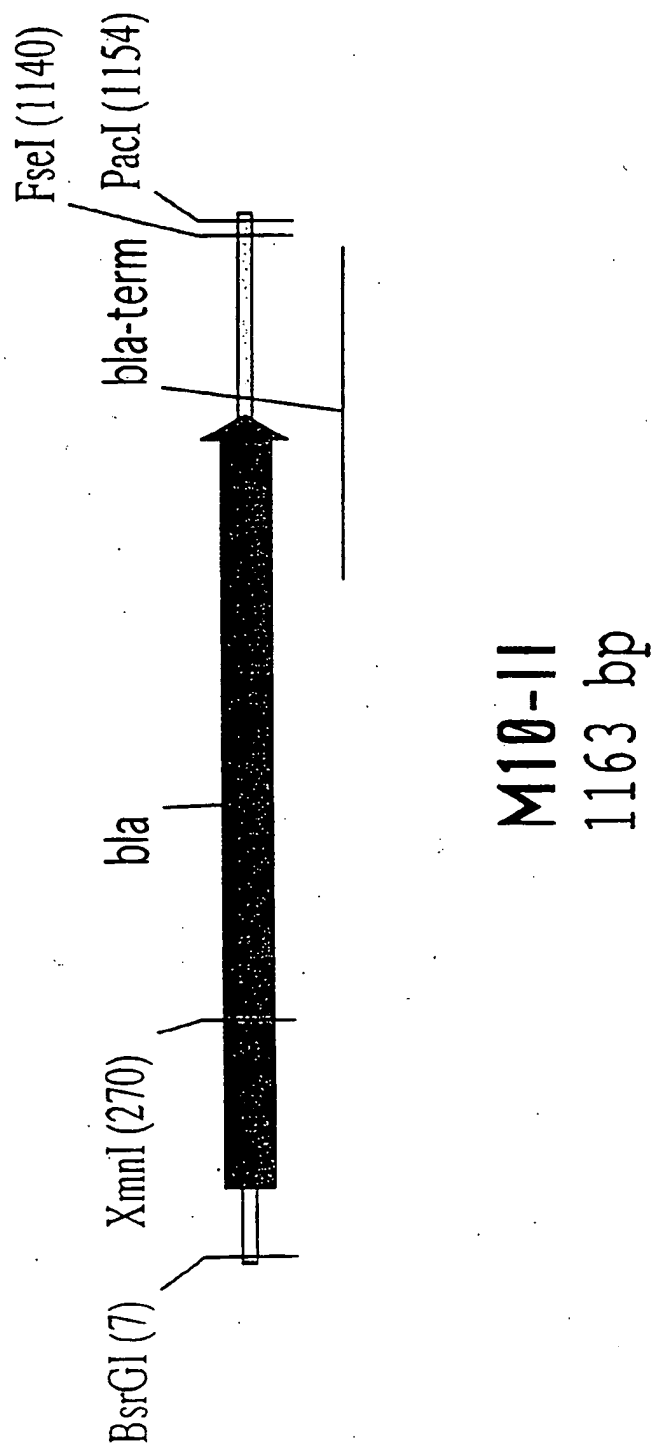


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

## M 10-II:

## BsrGI

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1  GGGGGTGTAC ATTCAAATAT GTATCCGCTC ATGAGACAAT AACCCGTGATA
   CCCCACATG TAAGTTTATA CATAGCGGAG TACTCTGTTA TTGGGACTAT

51 AATGCTTCAA TAATATTGAA AAAGGAAGAG TATGAGTATT CAACATTTC
   TTACGAAGTT ATTATAACTT TTTCCCTTCTC ATACTCATAA GTTGTAAGG

101 GTGTCGCCCT TATCCCTTT TTTGCGGCAT TTTGCCCTTCC TGTTTTTGCT
   CACAGCGGGA ATAAGGGAAA AAACGCCGTA AAACGGAAGG ACAAAAACGA

151 CACCAGAAA CGCTGGTGAA AGTAAAAGAT GCTGAGGATC AGTTGGGTGC
   GTGGGTCTTT GCGACCACTT TCATTCTTA CGACTCCTAG TCAACCCACG

201 GCGAGTGGGT TACATCGAAC TGGATCTCAA CAGCGGTAAG ATCCTTGAGA
   CGCTCACCCA ATGTAGCTTG ACCTAGAGTT GTCGCCATTC TAGGAACTCT

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XmnI

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251 GTTTTCGCCC CGAAGAACGT TTCCAATGA TGAGCACTTT TAAAGTTCTG
   CAAAAGCGGG GCTTCTTGCA AAAGTTACT ACTCGTGAAA ATTCAAGAC

```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

301	CTATGTGGCG	CGGTATTATC	CCGTATTGAC	GCCGGGCAAG	AGCAACTCGG
	GATACACCGC	GCCATAATAG	GGCATAACTG	CGGCCCGTTC	TCGTTGAGCC
351	TCGCCCGCATA	CACTATTCTC	AGAATGACTT	GGTTGAGTAC	TCACCAGTCA
	AGCGGCGGTAT	GTGATAAGAG	TCTTACTGAA	CCAACTCATG	AGTGGTCAGT
401	CAGAAAAGCA	TCTTACGGAT	GGCATGACAG	TAAGAGAATT	ATGCAGTGCT
	GTCCTTTTCGT	AGAATGCCCTA	CCGTACTGTC	ATTCTCTTAA	TACGTCACGA
451	GCCATAACCA	TGAGTGATAA	CACTGCGGCC	AACTTACTTC	TGACAAACGAT
	CGGTATTGGT	ACTCACTATT	GTGACGCCCG	TTGAATGAAG	ACTGTTGCTA
501	CGGAGGACCG	AAGGAGCTAA	CCGCTTTTTC	GCACAACATG	GGGGATCATG
	GCCTCCTGGC	TTCCCTCGATT	GGCGAAAAAA	CGTGTGTAC	CCCCTAGTAC
551	TAACTCGCCT	TGATCGTTGG	GAACCGGAGC	TGAATGAAGC	CATACCAAAC
	ATTGAGCGGA	ACTAGCAACC	CTTGGCCTCG	ACTTACTTCG	GTATGGTTTG
601	GACGAGCGTG	ACACCACGAT	GCCTGTAGCA	ATGGCAACAA	CGTTGCGCAA
	CTGCTCGCAC	TGTGGTGCTA	CGGACATCGT	TACCGTTGTT	GCAACGCGTT
651	ACTATTAACT	GGCGAACTAC	TTACTCTAGC	TTCCCCGGCAA	CAGTTAATAG
	TGATAAATTGA	CCGCTTGATG	AATGAGATCG	AAGGGCCGTT	GTCAATTATC

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

701	ACTGGATGGA GCGGGATAAA GTTGCAGGAC CACTTCTGCG CTCGGCCCCTT	TGACCTACCT CCGCCTATT CAACGTCCTG GTGAAGACGC GAGCCGGGAA
751	CCGGCTGGCT GGTTATTGCT TGATAAATCT GGAGCCGGTG AGCGTGGGTC	GGCCGACCGA CCAAATAACG ACTATTAGA CCTCGGCCAC TCGCACCCAG
801	TCGCGGTATC ATTGCAGCAC TGGGGCCAGA TGGTAAGCCC TCCC GTATCG	AGCGCCATAG TAACGTCGTG ACCCCGGTCT ACCATTCTGG AGGCGATAGC
851	TAGTTATCTA CACGACGGGG AGTCAGGCAA CTATGGATGA ACGAAATAGA	ATCAATAGAT GTGCTGCCCC TCAGTCCGTT GATACCTACT TGCTTTATCT
901	CAGATCGCTG AGATAGGTGC CTCACTGATT AAGCATTGGG TAACTGTCAG	GTCTAGCGAC TCTATCCACG GAGTGACTAA TTCGTAACCC ATTGACAGTC
951	ACCAAGTTA CTCATATATA CTTTAGATTG ATTTAAAACT TCATTTTAA	TGGTTCAAAT GAGTATATAT GAAATCTAAC TAAATTTTGA AGTAAAAATT
1001	TTTAAAAGGA TCTAGGTGAA GATCCCTTTT GATAATCTCA TGACCAAAT	AAATTTTCCT AGATCCACTT CTAGGAAAAA CTATTAGAGT ACTGGTTTA
1051	CCCTTAACGT GAGTTTTCGT TCCACTGAGC GTCAGACCCC GTAGAAAAGA	GGGAATTGCA CTCAAAAGCA AGTGACTCG CAGTCTGGG CATCTTTCT

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

		FseI	PacI
		~~~~~	~~
1101	TCAAAGGATC TTCTTGAGAT CCTTTTGAT AATGGCCGGC CCCCCCCTT		
	AGTTTCCTAG AAGAACTCTA GGAAAACTA TTACCGGCCG GGGGGGGAA		
	PacI		
	~~~~~		
1151	AATTAAGGG GGG		
	TTAATTCCCC CCC		

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

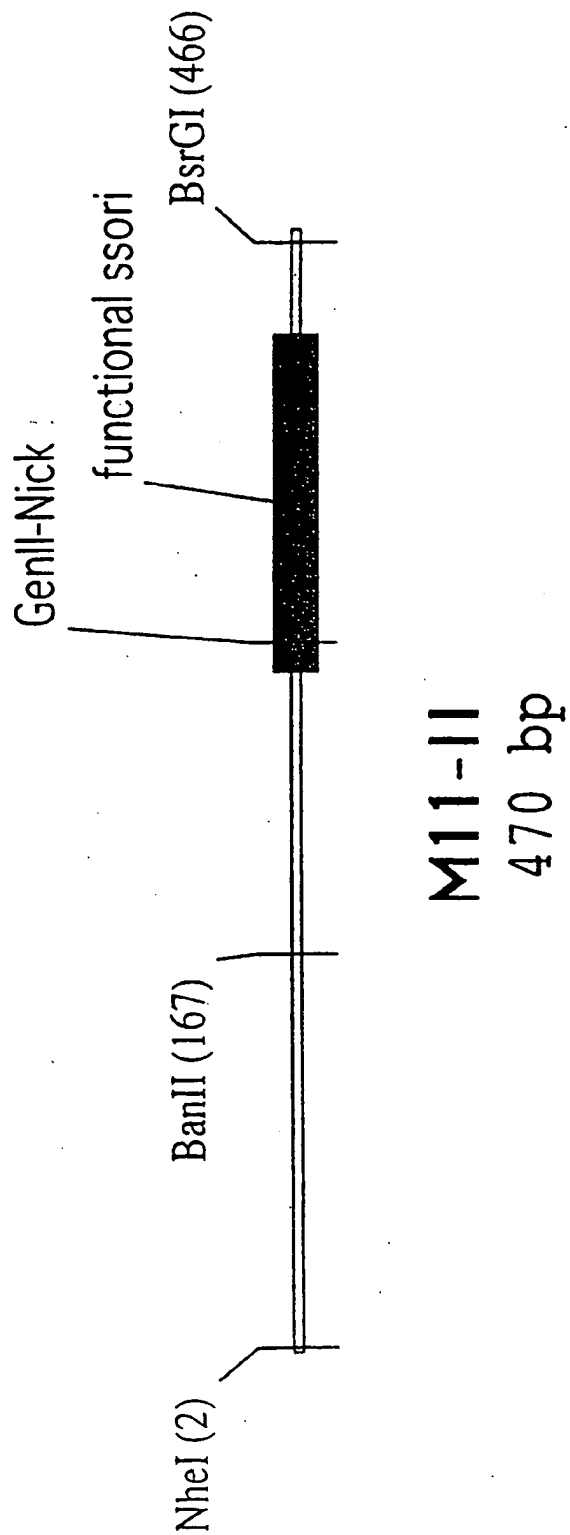


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

## M11-II:

NheI

~~~~~

1 GCTAGCACGC GCCCTGTAGC GCGGCATTAA GCGCGGCGGG TGTGGTGGTT
CGATCGTGCG CCGGACATCG CCGCGTAATT CCGCGCGCCC ACACCACCAA

51 ACGCGCAGCG TGACCGCTAC ACTTGCCAGC GCCCTAGCGC CCGCTCCTTT
TGCGCGTCGC ACTGGCGATG TGAACGGTCG CCGGATCGCG GCGAGGAAA

101 CGCTTCTTC CCTTCCTTTC TCGCCACGTT CGCGGGCTTT CCCCGTCAAG
GCGAAAGAAG GGAAGGAAAG AGCGGTGCAA GCGGCCGAAA GGGCAGTTC

BanII

~~~~~

151 CTCTAAATCG GGGCTCCCT TTAGGGTCC GATTAGTGC TTACGGCAC  
GAGATTAGC CCCCAGGGA AATCCCAAGG CTAAATCAGG AATGCCGTG

201 CTCGACCCCA AAAACTTGA TTAGGGTGAT GGTTCTCGTA GTGGGCCATC  
GAGCTGGGGT TTTTGAAC TATCCCACTA CCAAGAGCAT CACCCGGTAG

251 GCCCTGATAG ACGGTTTTC GCCCTTTGAC GTTGGAGTCC ACGTTCTTTA  
CGGACTATC TGCCAAAAG CCGGAAACTG CAACCTCAGG TGCAAGAAAT

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301  ATAGTGGACT CTTGTTCCAA ACTGGAACAA CACTCAACCC TATCTCGGTC
    TATCACCTGA GAACAAGGTT TGACCTTGTT GTGAGTTGGG ATAGAGCCAG

351  TATTCTTTTG ATTTATAAGG GATTTGCCG ATTTCGGCCT ATTGGTTAAA
    ATAAGAAAC TAAATATTCC CTAAACCGG TAAAGCCGGA TAACCAATTT

401  AAATGAGCTG ATTTAACAAA AATTAAACGC GAATTTTAAC AAAATATTAA
    TTTACTCGAC TAAATTGTTT TTAAATTGCG CTTAAAAATTG TTTTATAATT

451  CGTTTACAAT TTCATGTACA
    GCAAATGTTA AAGTACATGT
```

BSrGI

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

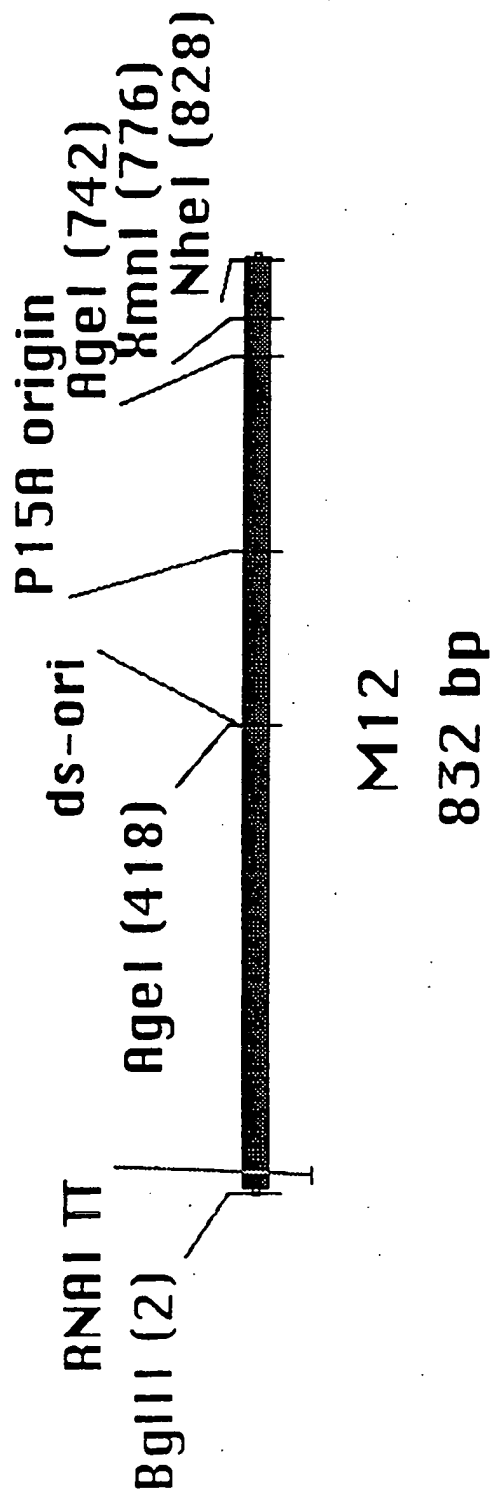


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| M 12: | | BglII | |
|-------|------------|------------|-------------|
| | | ~~~~~ | |
| 1 | AGATCTAATA | AGATGATCTT | CTTGAGATCG |
| | TCTAGATTAT | TCTACTAGAA | GAACTCTAGC |
| | | | AAAAACCAGAC |
| | | | GCGCATTAGA |
| 51 | CTTGCTCTGA | AAACGAAAAA | ACCGCCTTGC |
| | GAACGAGACT | TTTGCTTTTT | TGGCGGAACG |
| | | | TCCCGCCAAA |
| | | | AAGCATCCAA |
| | | | TTCTGTAGGTT |
| 101 | CTCTGAGCTA | CCAACTCTTT | GAACCGAGGT |
| | GAGACTCGAT | GGTTGAGAAA | CTTGCTCCA |
| | | | TTGACCGAAC |
| | | | CTCCTCGCGT |
| 151 | GTCACATAAA | CTTGTCCTTT | CAGTTAGCC |
| | CAGTGATTTT | GAACAGGAAA | GTCAAATCGG |
| | | | AATTGGCCGC |
| | | | GTACTGAAGT |
| 201 | AGACTAACTC | CTCTAAATCA | ATTACCAGTG |
| | TCTGATTGAG | GAGATTTAGT | TAATGGTCAC |
| | | | CGACGACGGT |
| | | | CACACGAAA |
| 251 | TGCATGTCTT | TCCGGGTTGG | ACTCAAGACG |
| | ACGTACAGAA | AGGCCCCAAC | TGAGTTCTGC |
| | | | TATCAATGGC |
| | | | CTATTCCGCG |
| 301 | AGCGGTCGGA | CTGAACGGGG | GGTTCGTGCA |
| | TCGCCAGCCT | GACTTGCCCC | CCAAGCACGT |
| | | | ATGTCAGGTC |
| | | | GAACCTCGCT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|-------|-------------|-------------|-------------|------------|-------------|
| 351 | ACTGCCCTACC | CGGAACCTGAG | TGTCAGGCGT | GGAATGAGAC | AAACGCGGCC |
| | TGACGGATGG | GCCTTGACTC | ACAGTCCGCA | CCTTACTCTG | TTTGCGCCGG |
| AgeI | | | | | |
| ~~~~~ | | | | | |
| 401 | ATAACAGCGG | AATGACACCG | GTAACCCGAA | AGGCAGGAAC | AGGAGAGCGC |
| | TATTGTCGCC | TTACTGTGGC | CATTGGCTT | TCCGTCCCTG | TCCTCTCGCG |
| 451 | AGGAGGGAGC | CGCCAGGGGG | AAACGCCCTGG | TATCTTTATA | GTCCTGTCTGG |
| | TCCTCCCTCG | GCGGTCCCCC | TTTGCGGACC | ATAGAAATAT | CAGGACAGCC |
| 501 | GTTTCGCCAC | CACTGATTG | AGCGTCAGAT | TTCGTGATGC | TTGTCAGGGG |
| | CAAAGCGGTG | GTGACTAAAC | TCGCAGTCTA | AAGCACTACG | AACAGTCCCC |
| 551 | GGCGGAGCCT | ATGGAAAAAC | GGCTTTGCCG | CGGCCCTCTC | ACTTCCCTGT |
| | CCGCCCTCGA | TACCTTTTG | CCGAAACGGC | GCCGGGAGAG | TGAAGGGACA |
| 601 | TAAGTATCTT | CCTGGCATCT | TCCAGGAAAT | CTCCGCCCCG | TTCGTAAGCC |
| | ATTCATAGAA | GGACCGTAGA | AGGTCCTTTA | GAGCGGGGC | AAGCATTCGG |
| 651 | ATTTCCGCTC | GCCGCAGTCG | AACGACCGAG | CGTAGCGAGT | CAGTGAGCGA |
| | TAAAGGCGAG | CGGCGTCAGC | TTGCTGGCTC | GCATCGCTCA | GTCACTCGCT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|-----|-------------|------------|------------|------------|------------|
| | | | | AgeI | |
| | | | | ~~~~~ | |
| 701 | GGAAGCGGAA | TATATCCTGT | ATCACATATT | CTGCTGACGC | ACCGGTGCAG |
| | CCTTCGCCCTT | ATATAGGACA | TAGTGTATAA | GACGACTGCG | TGGCCACGTC |
| | | | | | |
| | | | XmnI | | |
| | | | ~~~~~ | | |
| 751 | CCTTTTCTTCT | CCTGCCACAT | GAAGCACTTC | ACTGACACCC | TCATCAGTGC |
| | GGAAAAAAGA | GGACGGTGTA | CTTCGTGAAG | TGACTGTGGG | AGTAGTCACG |
| | | | | | |
| | | | NheI | | |
| | | | ~~~~~ | | |
| 801 | CAACATAGTA | AGCCAGTATA | CACTCCGCTA | GC | |
| | GTGTATCAT | TCGGTCATAT | GTGAGGCGAT | CG | |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

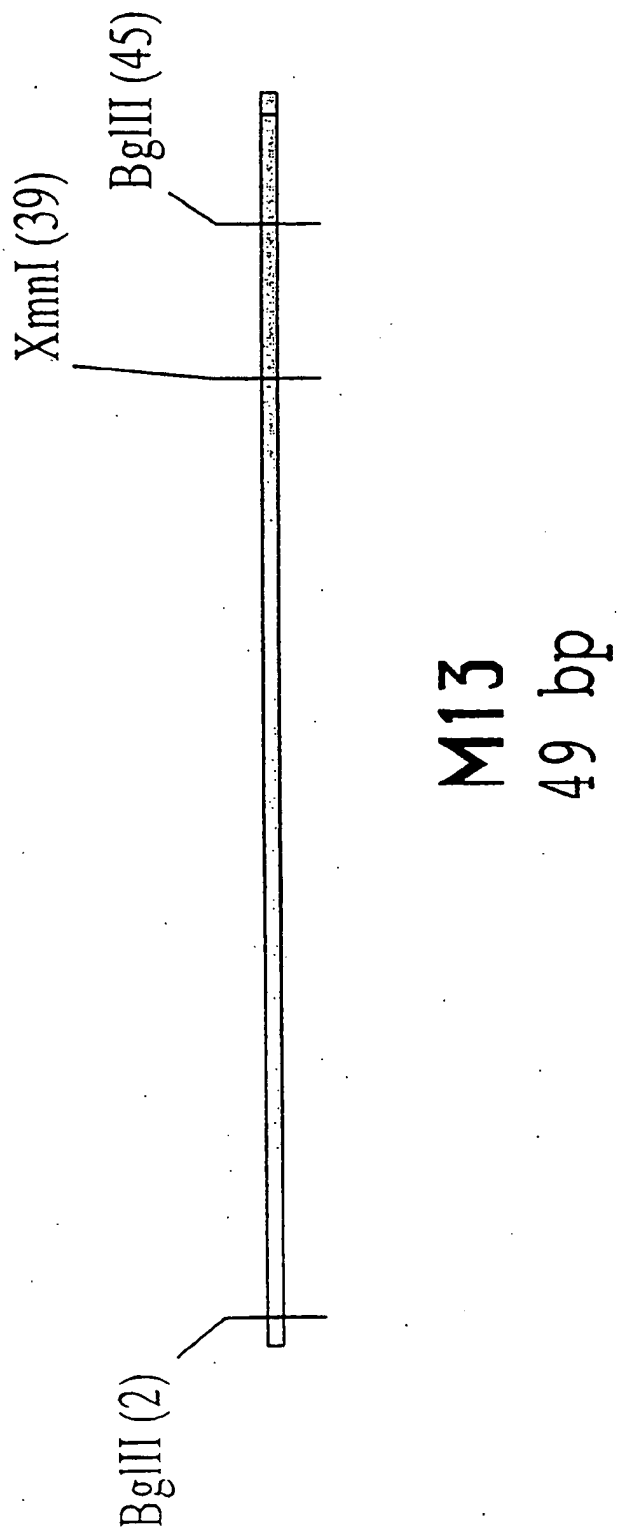


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 13:

| | BglII | XmnI | BglII |
|---|---|------|-------|
| 1 | AGATCTCATA ACTTCGTATA ATGTATGCTA TACGAAGTTA TTCAGATCT | | |
| | TCTAGAGTAT TGAAGCATAT TACATACGAT ATGCTTCAAT AAGCTTAGA | | |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

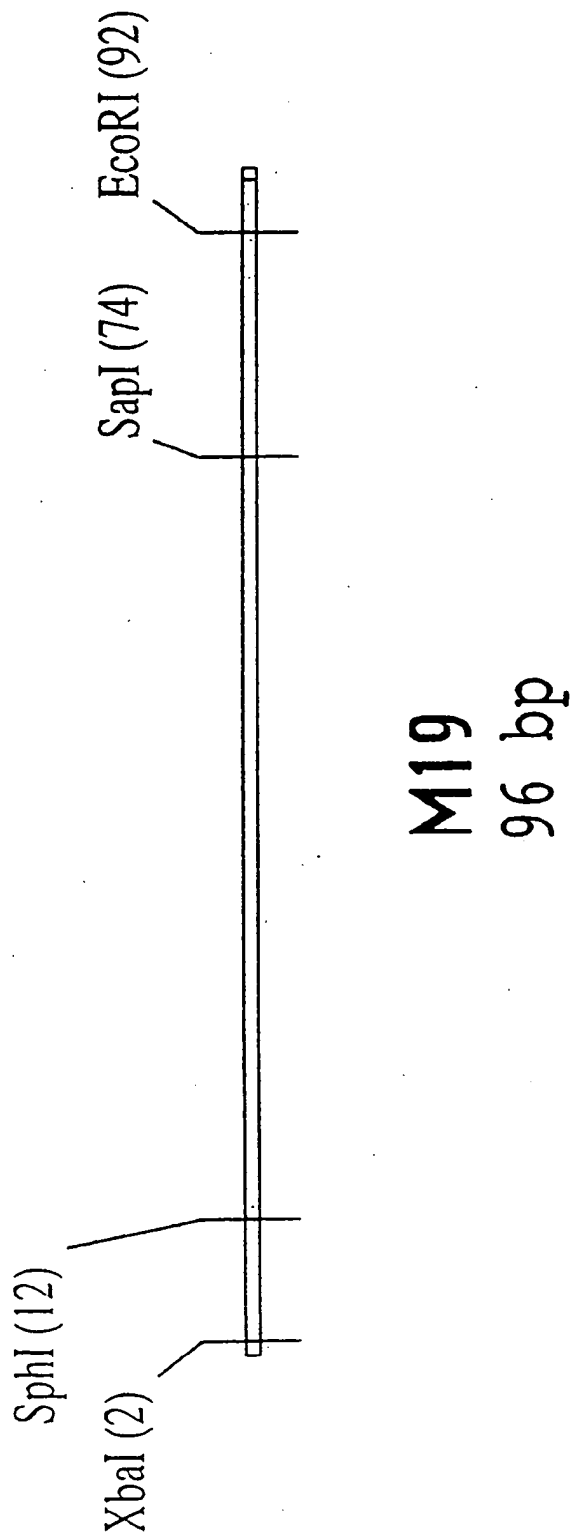


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 19:

| | XbaI | SphI | | | |
|----|------------|------------|------------|------------|------------|
| | ~~~~~ | | | | |
| 1 | TCTAGAGCAT | CGGTAGGAGA | AAATAAAATG | AAACAAGCA | CTATTGCACT |
| | AGATCTCGTA | CGCATCCTCT | TTTATTTTAC | TTTGTTTCGT | GATAACGTGA |
| | | | | | |
| | | SapI | | EcoRI | |
| | | ~~~~~ | | ~~~~~ | |
| 51 | GGCACTCTTA | CCGTTGCTCT | TCACCCCTGT | TACCAAAGCC | GAATTC |
| | CCGTGAGAAT | GGCAACGAGA | AGTGGGGACA | ATGGTTTCGG | CTTAAG |

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

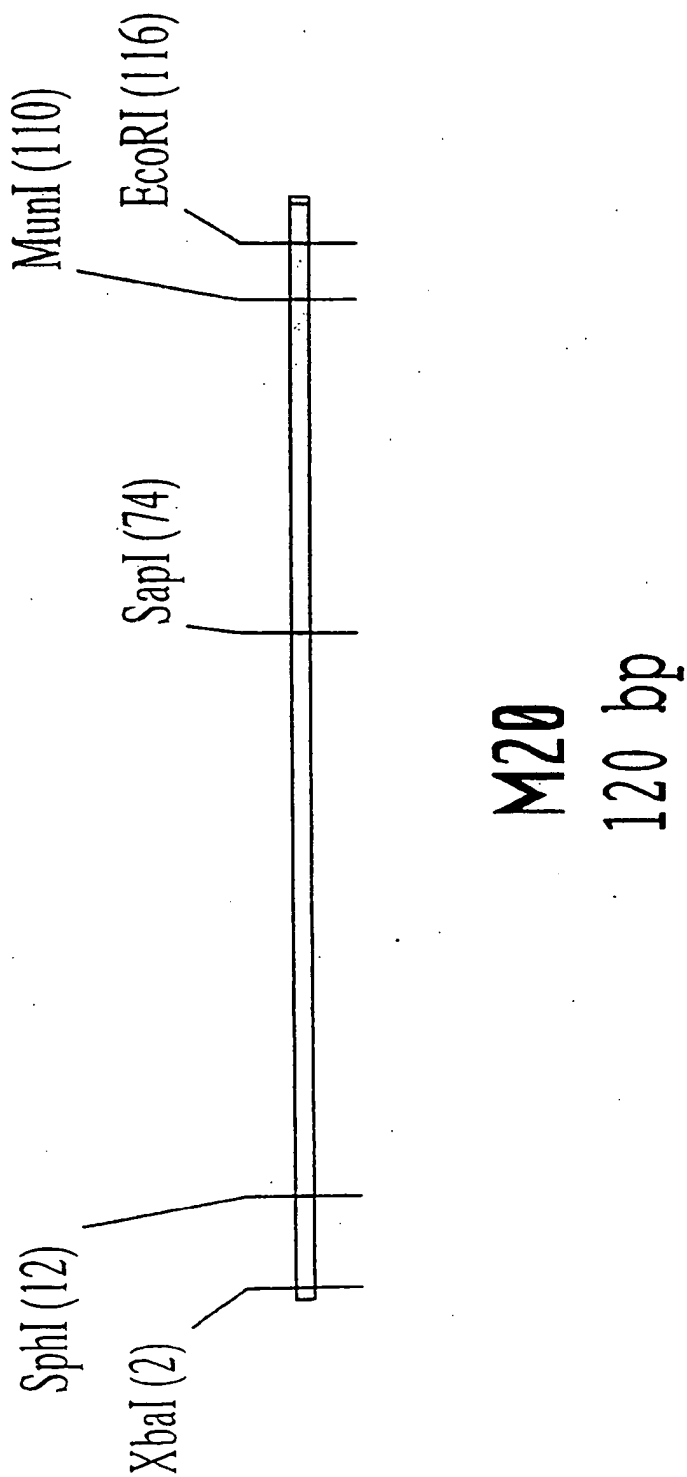


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 20:

| | | | |
|-----|-------------|------------|----------------------------------|
| | XbaI | SphI | |
| | ----- | ----- | |
| 1 | TCTAGAGCAT | GCGTAGGAGA | AAATAAATG AAACAAGCA CTATTGCACT |
| | AGATCTCGTA | CGCATCCTCT | TTTATTTTAC TTTGTTTCGT GATAACGTGA |
| | | | |
| | | SapI | |
| | | ----- | |
| 51 | GGCACTCTTA | CCGTTGCTCT | TCACCCCTGT TACCAAAGCC GACTACAAAG |
| | CCGTGAGAAAT | GGCAACGAGA | AGTGGGACA ATGGTTTCGG CTGATGTTTC |
| | | | |
| | MunI | EcoRI | |
| | ----- | ----- | |
| 101 | ATGAAGTGCA | ATTGGAATTC | |
| | TACTTCACGT | TAACCTTAAG | |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

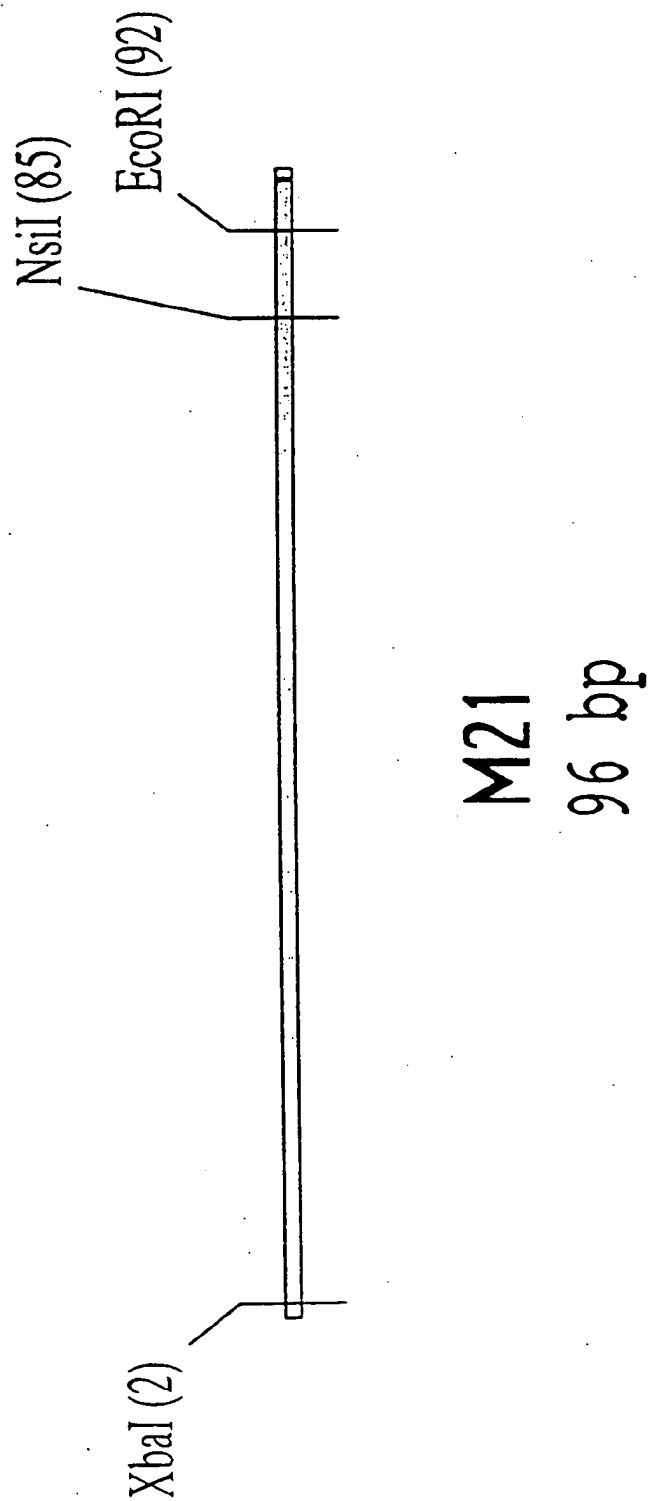


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 21:

XbaI

~~~~~

1 TCTAGAGGTT GAGGTGATTT TATGAAAAG AATATCGCAT TTCTTCTTGC  
 AGATCTCCAA CTCCTACTAA ATACTTTTTC TTATAGCGTA AAGAAGAACG

NsiI                      EcoRI

~~~~~

51 ATCTATGTTT GTTTTCTTCTA TTGCTACAAA TGCATACGCT GAATTC
 TAGATACAAG CAAAAAAGAT AACGATGTTT ACGTATGCCG CTTAAG

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

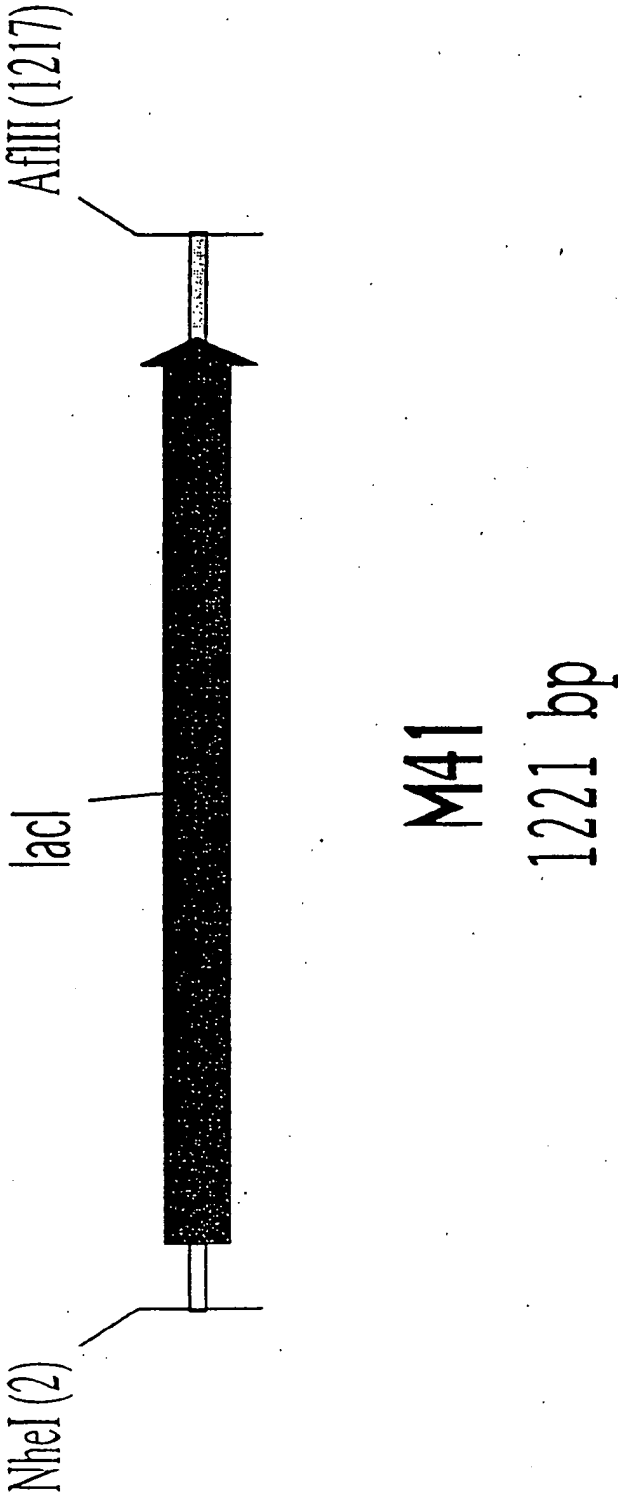


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 41:

NheI

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-----
1  GCTAGCATCG AATGGCGCAA AACCTTTCGC GGTATGGCAT GATAGCGCCC
   CGATCGTAGC TTACCGCGTT TTGGAAAGCG CCATACCGTA CTATCGCGGG

51  GGAAGAGAGT CAATTCAGGG TGGTGAATGT GAAACCAGTA ACGTTATACG
   CCTTCTCTCA GTTAAGTCCC ACCACTTACA CTTTGGTCAT TGCAATATGC

101 ATGTCGCAGA GTATGCCGGT GTCTCTTATC AGACCGTTTC CCGCGTGGTG
   TACAGCGTCT CATACGGCCA CAGAGAATAG TCTGGCAAAG GGCGCACCCAC

151 AACCAGGCCA GCCACGTTTC TGCGAAACG CGGGAACAAAG TGGAAAGCGGC
   TTGGTCCGGT CCGTGCAAAG ACGCTTTTGC GCCCTTTTTC ACCTTCGCCC

201 GATGGCGGAG CTGAATTACA TTCCCTAACCG CGTGGCACAA CAACTGGCGG
   CTACCGCCCTC GACTTAATGT AAGGATTGGC GCACCGTGTT GTTGACCGCC

251 GCAAACAGTC GTTGCTGATT GGCGTTGCCA CCTCCAGTCT GGCCCTGCAC
   CGTTTGTGAG CAACGACTAA CCGCAACGGT GGAGGTCAGA CCGGACGTG

301 GCGCCGTCGC AAATTGTCGC GGCGATTAAA TCTCGCGCCG ATCAACTGGG
   CGCGGCAGCG TTAAACAGCG CCGCTAATTT AGAGCGCGGC TAGTTGACCC

```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|-----|------------|-------------|------------|------------|-------------|
| 351 | TGCCAGCGTG | GTCGTGTCGA | TGGTAGAACG | AAGCGGCGTC | GAAGCCTGTA |
| | ACGGTCGCAC | CAGCACAGCT | ACCATCTTGC | TTGCGCCGAC | CTTCGGACAT |
| 401 | AAGCGGCGGT | GCACAAATCTT | CTCGCGCAAC | GTGTCAGTGG | GCTGATTATT |
| | TTCGCCGCCA | CGTGTTAGAA | GAGCGCGTTG | CACAGTCACC | CGACTAATAA |
| 451 | AACTATCCGC | TGGATGACCA | GGATGCTATT | GCTGTGGAAG | CTGCCTGCAC |
| | TTGATAGGCG | ACCTACTGGT | CCTACGATAA | CGACACCTTC | GACGGACGTG |
| 501 | TAATGTTCGG | GCGTTATTTC | TTGATGTCTC | TGACCAGACA | CCCATCAACA |
| | ATTACAAGGC | CGCAATAAAG | AACTACAGAG | ACTGGTCTGT | GGGTAGTTGT |
| 551 | GTATTATTTT | CTCCCATGAG | GACGGTACGC | GACTGGGCGT | GGAGCATCTG |
| | CATAATAAAA | GAGGGTACTC | CTGCCATGCG | CTGACCCGCA | CCTCGTAGAC |
| 601 | GTCGCATTGG | GCCACCAGCA | AATCGCGCTG | TTAGCTGGCC | CATTAAAGTTC |
| | CAGCGTAACC | CGGTGGTTCG | TTAGCGCGAC | AATCGACCCG | GTAATTCAAG |
| 651 | TGTCTCGGCG | CGTCTGCGTC | TGGCTGGCTG | GCATAAATAT | CTCACTCGCA |
| | ACAGAGCCGC | GCAGACGCAG | ACCGACCGAC | CGTATTTATA | GAGTGAGCGT |
| 701 | ATCAAATTCA | GCCGATAGCG | GAACGGGAAG | GCGACTGGAG | TGCCATGTCC |
| | TAGTTTAAGT | CGGCTATCGC | CTTGCCCTTC | CGCTGACCTC | ACGGTACAGG |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|------|------------|------------|-------------|-------------|-------------|
| 751 | GGTTTCAAC | AAACCATGCA | AATGCTGAAT | GAGGGCATCG | TTCCCCACTGC |
| | CCAAAAGTTG | TTTGGTACGT | TTACGACTTA | CTCCCCGTAGC | AAGGGTGACG |
| 801 | GATGCTGGTT | GCCAACGATC | AGATGGCGCT | GGGCGCAATG | CGTGCCATTA |
| | CTACGACCAA | CGGTTGCTAG | TCTACCGCGA | CCCGCGTTAC | GCACGGTAAT |
| 851 | CCGAGTCCGG | GCTGCGCGTT | GGTGCGGACA | TCTCGGTAGT | GGGATACGAC |
| | GGCTCAGGCC | CGACGCGCAA | CCACGCCCTGT | AGAGCCATCA | CCCTATGCTG |
| 901 | GATACCGAGG | ACAGCTCATG | TTATATCCCG | CCGCTGACCA | CCATCAAACA |
| | CTATGGCTCC | TGTCGAGTAC | AATATAGGC | GGCGACTGGT | GGTAGTTTGT |
| 951 | GGATTTTCGC | CTGCTGGGGC | AAACCAGCGT | GGACCGCTTG | CTGCAACTCT |
| | CCTAAAAGCG | GACGACCCCG | TTTGGTCGCA | CCTGGCGAAC | GACGTTGAGA |
| 1001 | CTCAGGGCCA | GGCGGTGAAG | GGCAATCAGC | TGTTGCCCGT | CTCACTGGTG |
| | GAGTCCCGGT | CCGCCACTTC | CCGTTAGTCG | ACAACGGGCA | GAGTGACCAC |
| 1051 | AAAAGAAAAA | CCACCCTGGC | TCCCAATACG | CAAACCGCCT | CTCCCCGCGC |
| | TTTTCTTTTT | GGTGGGACCG | AGGGTTATGC | GTTTGGCGGA | GAGGGGCGCG |
| 1101 | GTTGGCCGAT | TCACTGATGC | AGCTGGCACG | ACAGGTTTCC | CGACTGGAAA |
| | CAACCGGCTA | AGTGACTACG | TCGACCGTGC | TGTCCAAAGG | GCTGACCCTT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

1151 GCGGGCAGTG AGGCTACCCG ATAAAGCGG CTTCCCTGACA GGAGGCCCGTT
CGCCCGTCAC TCCGATGGGC TATTTCGCC GAAGGACTGT CCTCCGGCAA

AflII

~~~~~

1201 TTGTTTGCA GCCCACTTAA G  
AACAAACGT CGGTGAATT C

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

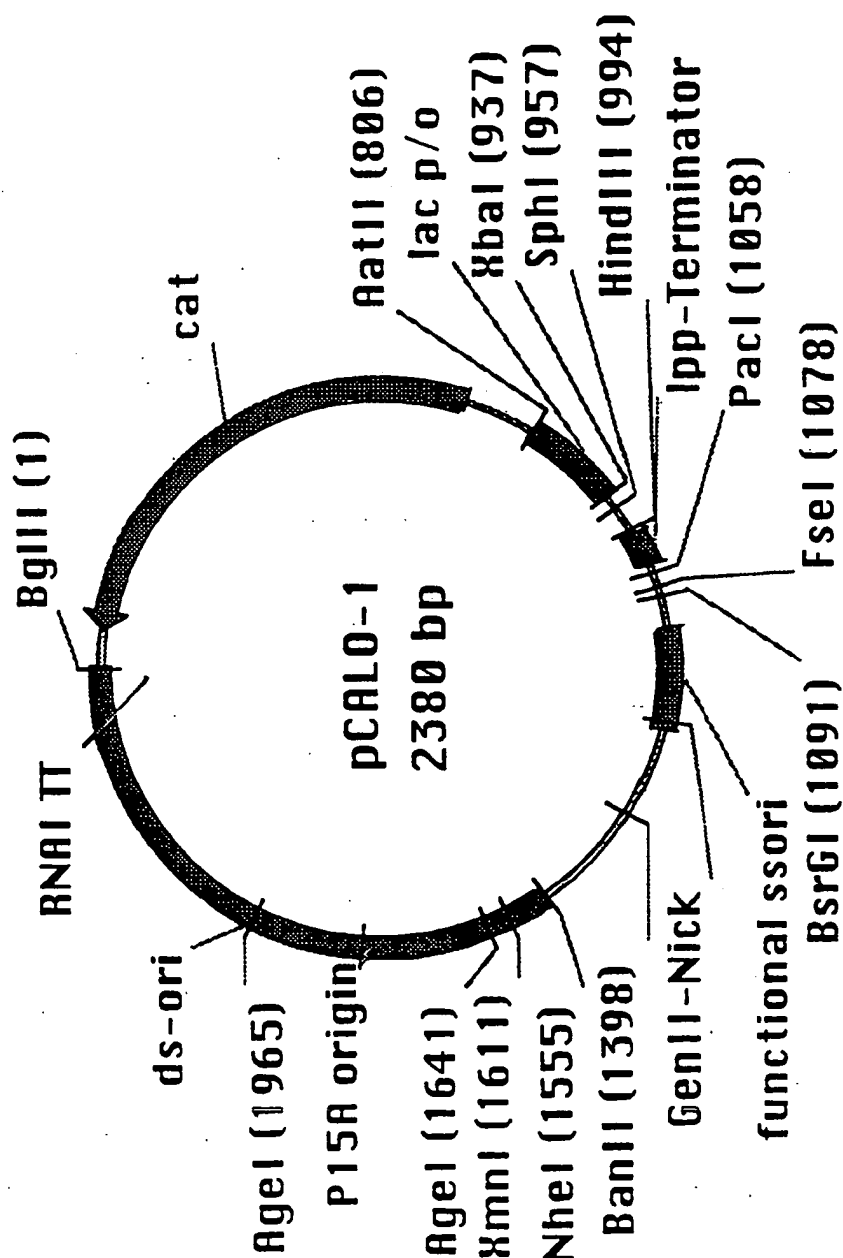


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCALO-1:  
 BglII  
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| | | | | | |
|-----|------------|-------------|-------------|-------------|-------------|
| 1 | GATCTAGCAC | CAGCGGTTTA | AGGCACCCAA | TAACTGCCCTT | AAAAAATTA |
| | CTAGATCGTG | GTCCGCAAAAT | TCCCGTGGTT | ATTGACGGAA | TTTTTTTAAAT |
| 51 | CGCCCCGCC | TGCCACTCAT | CGCAGTACTG | TTGTAATTCA | TTAAGCATTC |
| | GCGGGCGGG | ACGGTGAGTA | GCGTCATGAC | AACATTAAGT | AATTCGTAAG |
| 101 | TGCCGACATG | GAAGCCATCA | CAAACGGCAT | GATGAACCTG | AATCGCCAGC |
| | ACGGCTGTAC | CTTCGGTAGT | GTTTGCCGTA | CTACTTGGAC | TTAGCGGTCG |
| 151 | GGCATCAGCA | CCTTGTCGCC | TTGCGTATAA | TATTTGCCCA | TAGTGAAAAC |
| | CCGTAGTCGT | GGAACAGCGG | AACGCATATT | ATAAACGGGT | ATCACTTTTG |
| 201 | GGGGGCCGAG | AAGTTGTCCA | TATTGGCTAC | GTTTAAATCA | AAACTGGTGA |
| | CCCCCGCTTC | TTCAACAGGT | ATAACCGATG | CAAATTTAGT | TTTGACCACT |
| 251 | AACTCACCCA | GGGATTGGCT | GAGACGAAA | ACATATTCTC | AATAAACCCCT |
| | TTGAGTGGGT | CCCTAACCGA | CTCTGCTTTT | TGTATAAGAG | TTATTTTGGGA |
| 301 | TTAGGGAAAT | AGGCCAGGTT | TTCACCCGTAA | CACGCCACAT | CTTGCGAATA |
| | AATCCCCTTA | TCCGGTCCAA | AAGTGGCATT | GTGCGGTGTA | GAACGCTTAT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | |
|-----|--|
| 351 | TATGTGTAGA AACTGCCGGA AATCGTCGTG GTATTCATC CAGAGCGATG
ATACACATCT TTGACGGCCT TTAGCAGCAC CATAAGTGAG GTCTCGCTAC |
| 401 | AAAACGTTTC AGTTTGCTCA TGGAAAACGG TGTAACAAGG GTGAACACTA
TTTTGCAAG TCAAACGAGT ACCTTTTGCC ACATTGTTCC CACTTGTGAT |
| 451 | TCCCATATCA CCAGCTCACC GTCTTTCATT GCCATACGGA ACTCCGGGTG
AGGGTATAGT GGTCGAGTGG CAGAAAGTAA CGGTATGCCT TGAGGCCCCAC |
| 501 | AGCATTCATC AGCGGGGCAA GAATGTGAAT AAAGGCCGGA TAAAACTTGT
TCGTAAGTAG TCCGCCCGTT CTTACACTTA TTTCCGGCCT ATTTGAACA |
| 551 | GCTTATTTT CTTACGGTC TTTAAAAAGG CCGTAATATC CAGCTGAACG
CGAATAAAAA GAAATGCCAG AAATTTTCC GCATTATAG GTCGACTTGC |
| 601 | GTCTGGTTAT AGGTACATTG AGCAACTGAC TGAAATGCCCT CAAAATGTTT
CAGACCAATA TCCATGTAAC TCGTTGACTG ACTTTACGGA GTTTTACAAG |
| 651 | TTTACGATGC CATTGGGATA TATCAACGGT GGATATATCCA GTGATTTTTT
AAATGCTACG GTAACCCCTAT ATAGTTGCCA CCATATAGGT CACTAAAAAA |
| 701 | TCTCCATTT AGCTTCCTTA GCTCCTGAAA ATCTCGATAA CTCAAAAAAT
AGAGGTAAAA TCGAAGGAAT CGAGGACTTT TAGAGCTATT GAGTTTTTA |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

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751  ACGCCCGGTA GTGATCTTAT TTCATTATGG TGAAAGTTGG AACCTCACCC
    TCGGGGCCAT CACTAGAATA AAGTAATACC ACTTCAACC TTGGAGTGGG

    AatII
    ~~~~~
801  GACGTCTAAT GTGAGTTAGC TCACTCATTA GGCACCCAG GCTTTACACT
    CTGCAGATTA CACTCAATCG AGTGAGTAAT CCGTGGGTC CGAAATGTGA

851  TTATGCTTCC GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT
    AATACGAAGG CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA

                                XbaI
                                ~~~~~
901  CACACAGGAA ACAGCTATGA CCATGATTAC GAATTCTAG ACCCCCCCCC
    GTGTGTCCTT TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG

                                SphI
                                ~~~~~
951  CGCATGCCAT AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA
    GCGTACGGTA TTGAAGCATA TTACATGCCA TATGCTTCAA TATTCGAACT

1001 CCTGTGAAGT GAAAATGGC GCAGATTGTG CGACATTTT TTTGTCTGCC
    GGACACTTCA CTTTTTACCG CGTCTAACAC GCTGTAAAAA AACAGACGG

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | PacI | FseI | BsrGI |
|------|---|-------|-------|
| | ~~~~~ | ~~~~~ | ~~~~~ |
| 1051 | GTTTAAATTAA AGGGGGGGG GGGCCGGCCT GGGGGGGGT GTACATGAAA
CAAATTAATT TCCCCCCCCC CCGGCCGGA CCCCCCCCA CATGTACTTT | | |
| 1101 | TTGTAAACGT TAATATTTTG TTAAATTCG CGTTAAATTT TTGTAAATC
AACATTTGCA ATTATAAAC AATTTTAAGC GCAATTTAAA AACAAATTTAG | | |
| 1151 | AGCTCATTTT TTAACCAATA GGCCGAAATC GGCAAAATCC CTTATAAATC
TCGAGTAAAA AATTGGTTAT CCGCTTTAG CCGTTTTAGG GAATATTTAG | | |
| 1201 | AAAAGAATAG ACCGAGATAG GGTGAGTGT TGTTCAGTT TGGAAACAAGA
TTTTCCTATC TGGCTCTATC CCAACTCACA ACAAGGTCAA ACCTTGTTCT | | |
| 1251 | GTCCACTATT AAAGAACGTG GACTCCAACG TCAAAGGGCG AAAAACCGTC
CAGGTGATAA TTTCCTTGCAC CTGAGGTTGC AGTTTCCCGC TTTTGGGCAG | | |
| 1301 | TATCAGGGCG ATGGCCCACT ACGAGAACCA TCACCCCTAAT CAAGTTTTTT
ATAGTCCCCG TACCGGGTGA TGCTCTTGGT AGTGGGATTA GTTCAAAAAA | | |
| | | | BanII |
| | | | ~~~~~ |
| 1351 | GGGGTCGAGG TGCCGTAAAG CACTAAATCG GAACCCCTAAA GGGAGCCCCC
CCCCAGCTCC ACGGCATTTC GTGATTTAGC CTTGGGATTT CCCTCGGGGG | | |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued).

| | | | | | |
|------|---------------|------------|-------------|------------|-------------|
| | GATGCGAGCC | AGCAAGCTGA | CGCCGCTCGC | CTTTACCGAA | TGCTTGCCCC |
| 1751 | CGGAGATTTC | CTGGAAGATG | CCAGGAAGAT | ACTTAACAGG | GAAGTGAGAG |
| | GCCTCTAAAG | GACCTTCTAC | GGTCCCTTCTA | TGAATTGTCC | CTTCACTCTC |
| 1801 | GGCCGCGGCA | AAGCCGTTTT | TCCATAGGCT | CCGCCCCCCT | GACAAGCATC |
| | CCGCGGCCGT | TTCGGCAAAA | AGGTATCCGA | GGCGGGGGA | CTGTTCTGTAG |
| 1851 | ACGAAATCTG | ACGCTCAAAT | CAGTGGTGGC | GAAACCCGAC | AGGACTATAA |
| | TGCTTTAGAC | TGCGAGTTTA | GTCACCACCG | CTTTGGGCTG | TCCTGATATT |
| 1901 | AGATACCAGG | CGTTTCCCCC | TGGCGGCTCC | CTCCTGCGCT | CTCCTGTTCC |
| | TCTATGGTCC | GCAAAGGGGG | ACCGCCGAGG | GAGGACGCCA | GAGGACAAGG |
| | AgeI
~~~~~ | | | | |
| 1951 | TGCCTTTTCGG | TTTACCAGTG | TCATTCCGCT | GTTATGGCCG | CGTTTGCTCTC |
| | ACGGAAAGCC | AAATGGCCAC | AGTAAGGCCA | CAATACCCGC | GCAAAACAGAG |
| 2001 | ATTCCACGCC | TGACACTCAG | TTCCGGGTAG | GCAGTTCGCT | CCAAGCTGGA |
| | TAAGGTGCGG | ACTGTAGTC | AAGCCCCATC | CGTCAAGCCA | GGTTCGACCT |
| 2051 | CTGTATGCAC | GAACCCCCCG | TTCAGTCCGA | CCGCTGCGCC | TTATCCGGTA |
| | GACATACGTG | CTTGGGGGGC | AAGTCAGGCT | GGCGACGCGG | AATAGGCCAT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|------|-------------|-------------|-------------|------------|-------------|
| 1401 | GATTAGAGC | TTGACGGGGA | AAGCCGGCGA | ACGTGGCGAG | AAAGGAAGGG |
| | CTAAATCTCG | AACTGCCCCCT | TTCGGCCCGCT | TGCACCGCTC | TTTCCCTTCCC |
| 1451 | AAGAAAGCGA | AAGGAGCGGG | CGCTAGGGCG | CTGGCAAGTG | TAGCGGTCAC |
| | TTCTTTTCGCT | TTCCCTCGCCC | GCGATCCCCG | GACCGTTCAC | ATCGCCAGTG |
| 1501 | GCTGCGCGTA | ACCACCACAC | CCGCCGCGCT | TAATGCGCCG | CTACAGGGCG |
| | CGACGCGCAT | TGGTGGTGTG | GGCGGCGCGA | ATTACGCGGC | GATGTCCCCG |
| NheI | | | | | |
| | ~~~~~ | | | | |
| 1551 | CGTGCTAGCG | GAGTGATAC | TGGCTTACTA | TGTTGGCACT | GATGAGGGTG |
| | GCACGATCGC | CTCACATATG | ACCGAATGAT | ACAACCGTGA | CTACTCCCCAC |
| XmnI | | | | | |
| | ~~~~~ | | | | |
| 1601 | TCAGTGAAGT | GCTTCATGTG | GCAGGAGAAA | AAAGGCTGCA | CCGGTGCGTC |
| | AGTCACCTCA | CGAAGTACAC | CGTCCTCTTT | TTTCCGACGT | GGCCACGCAG |
| 1651 | AGCAGAATAT | GTGATACAGG | ATATATTCCG | CTTCCTCGCT | CACTGACTCG |
| | TCGTCTTATA | CACTATGTCC | TATATAAGGC | GAAGGAGCGA | GTGACTGAGC |
| 1701 | CTACGCTCGG | TCGTTGCACT | GCGGCGAGCG | GAAATGGCTT | ACGAACGGGG |
| | | | | | AgeI |
| | | | | | ~~~~~ |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| 2101 | ACTATCGTCT
TGATAGCAGA | TGAGTCCAAC
ACTCAGGTTG | CCGGAAGAC
GGCCTTTCG | ATGCAAAAGC
TACGTTTTCG | ACCACTGGCA
TGGTGACCGT |
| 2151 | GCAGCCACTG
CGTCGGTGAC | GTAATTGATT
CATTAACATA | TAGAGGAGTT
ATCTCCTCAA | AGTCTTGAAG
TCAGAACTTC | TCATGCCGCCG
AGTACGCCGC |
| 2201 | GTTAAGGCTA
CAATTCCGAT | AACTGAAAGG
TTGACTTTCC | ACAAGTTTTA
TGTTCAAAAT | GTGACTGCCG
CACTGACCGG | TCCTCCAAGC
AGGAGGTTTCG |
| 2251 | CAGTTACCTC
GTCAATGGAG | GGTTCAAAGA
CCAAGTTTCT | GTTGGTAGCT
CAACCATCGA | CAGAGAACCT
GTCTCTTGGA | ACGAAAACCC
TGCTTTTTCG |
| 2301 | GCCCTGCAAG
CGGGACGTC | GCGGTTTTTT
CGCCAAAAAA | CGTTTTCAGA
GCAAAAGTCT | GCAAGAGATT
CGTTCTCTAA | ACGCCCAGAC
TGCCGCGTCTG |
| 2351 | CAAACGATC
GTTTGTCTAG | TCAAGAAGAT
AGTTCTTCTA | CATCTTATTA
GTAGAATAAT | | |

BgIII

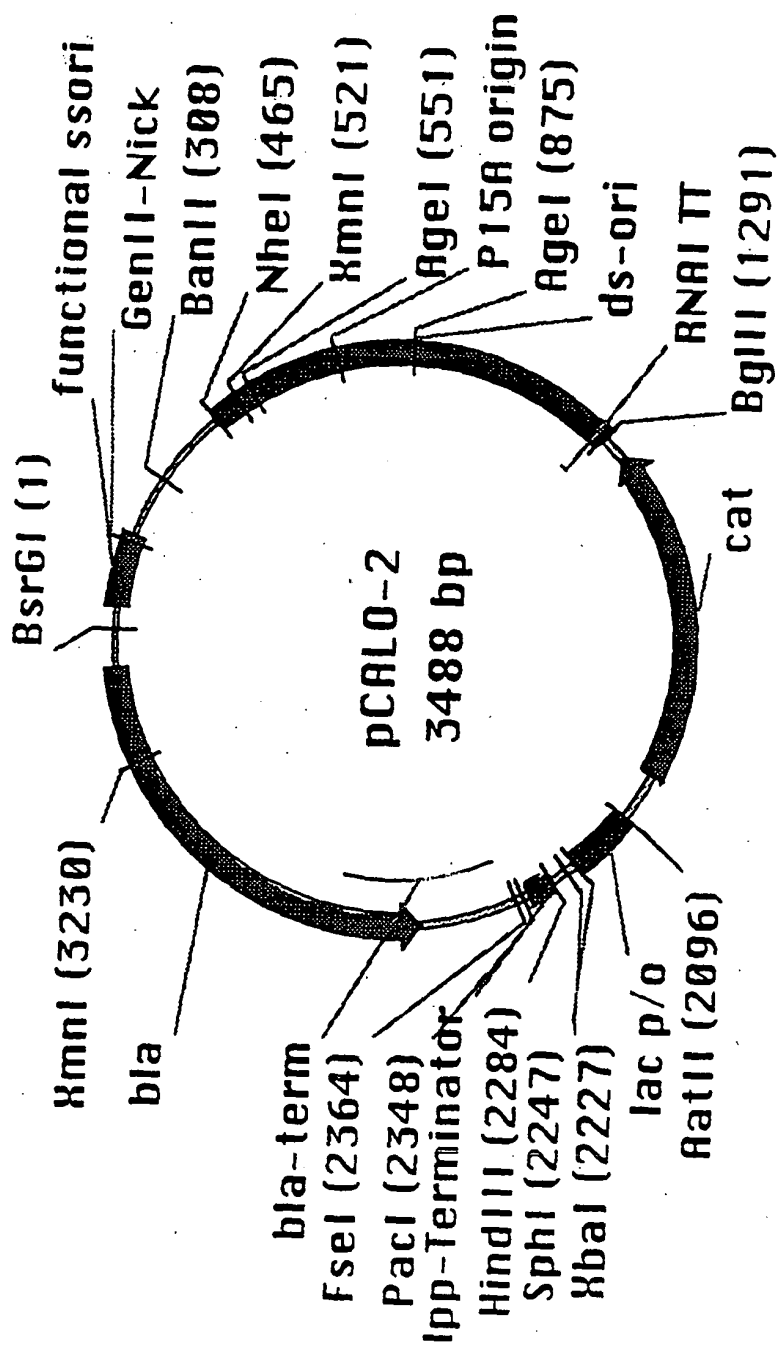


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCALO-2:

BsrGI

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1	GTACATGAAA	TTGTAACGT	TAATATTTG	TTAAAAATTCG	CGTTAAATTT
	CATGTACTTT	AACATTGCA	ATTATAAAC	AATTTAAGC	GCAATTTAAA
51	TTGTAAATC	AGCTCATTTT	TTAACCAATA	GGCCGAAATC	GGCAAAATCC
	AACAATTTAG	TCGAGTAAA	AATTGGTTAT	CCGGCTTTAG	CCGTTTTAGG
101	CTTATAAATC	AAAAGAAATAG	ACCGAGATAG	GGTTGAGTGT	TGTTCCAGTT
	GAATATTTAG	TTTTTCTTATC	TGGCTCTATC	CCAAC TCACA	ACAAGGTCAA
151	TGGAACAAGA	GTCCACTATT	AAAGAACGTG	GACTCCAACG	TCAAAGGGCG
	ACCTTGTTCT	CAGGTGATAA	TTTCTTGCAC	CTGAGGTTGC	AGTTTCCCCG
201	AAAACCCGTC	TATCAGGGCG	ATGGCCCACT	ACGAGAACCA	TCACCCCTAAT
	TTTTTTGGCAG	ATAGTCCCGC	TACCGGGTGA	TGCTCTTGGT	AGTGGGATTA
251	CAAGTTTTTT	GGGGTCGAGG	TGCCGTAAAG	CACTAAATCG	GAACCCATAA
	GTTCAAAAAA	CCCCAGCTCC	ACGGCATTTT	GTGATTTAGC	CTTGGGATTT
301	GGGAGCCCCC	GATTAGAGC	TTGACGGGGA	AAGCCGGCGA	ACGTGGCGAG

BanII

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|-----|-------------|------------|------------|------------|------------|
| | GTGACTGAGC | GATGCGAGCC | AGCAAGCTGA | CGCCGCTCGC | CTTTACCGAA |
| 651 | ACGAACGGGG | CGGAGATTTC | CTGGAAGATG | CCAGGAAGAT | ACTTAACAGG |
| | TGCTTGCCCC | GCCTCTAAG | GACCTTCTAC | GTCCCTTCTA | TGAATTGTCC |
| 701 | GAAGTGAGAG | GGCCGCGGCA | AAGCCGTTT | TCCATAGGCT | CCGCCCCCT |
| | CTTCACTCTC | CCGGCGCCGT | TTCGGCAAAA | AGGTATCCGA | GGCGGGGGGA |
| 751 | GACAAGCATC | ACGAAATCTG | ACGCTCAAAT | CAGTGGTGGC | GAAACCCGAC |
| | CTGTTTCGTAG | TGCTTTAGAC | TGCGAGTTTA | GTCACCACCG | CTTTGGGCTG |
| 801 | AGGACTATAA | AGATACCAGG | CGTTTCCCCC | TGGCGGCTCC | CTCCTGCGCT |
| | TCCTGATATT | TCTATGGTCC | GCAAAGGGGG | ACCGCCGAGG | GAGACGCGA |
| | | | AgeI | | |
| | | | ~~~~~ | | |
| 851 | CTCCTGTTC | TGCCTTTCGG | TTTACCAGTG | TCATTCCGCT | GTTATGGCCG |
| | GAGGACAAGG | ACGGAAGCC | AAATGGCCAC | AGTAAGGCGA | CAATACCGGC |
| 901 | CGTTTGTCTC | ATTCCACGCC | TGACACTCAG | TTCCGGGTAG | GCAGTTCGCT |
| | GCAAACAGAG | TAAGGTGCCG | ACTGTGAGTC | AAGGCCCATC | CGTCAAGCGA |
| 951 | CCAAGCTGGA | CTGTATGCAC | GAACCCCCCG | TTCAGTCCGA | CCGCTGCGCC |
| | GGTTCGACCT | GACATACGTG | CTTGGGGGGC | AAGTCAGGCT | GGCGACGCGG |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|-------|------------|------------|------------|------------|------------|
| 1001 | TTATCCGGTA | ACTATCGTCT | TGAGTCCAAC | CCGGAAGAC | ATGCAAAAGC |
| | AATAGGCCAT | TGATAGCAGA | ACTCAGGTG | GGCCTTCTG | TACGTTTTCG |
| 1051 | ACCACTGGCA | GCAGCCACTG | GTAATTGATT | TAGAGGAGTT | AGTCTTGAAG |
| | TGGTGACCGT | CGTCGGTGAC | CATTAACATA | ATCTCCTCAA | TCAGAACTTC |
| 1101 | TCATGCGCCG | GTTAAGGCTA | AACTGAAAGG | ACAAGTTTAA | GTGACTGCCG |
| | AGTACGCGGC | CAATTCCGAT | TTGACTTTCC | TGTTCAAAAT | CACTGACGCG |
| 1151 | TCCTCCAAGC | CAGTTACCTC | GGTTCAAAGA | GTTGGTAGCT | CAGAGAACCT |
| | AGGAGGTTCG | GTCAATGGAG | CCAAGTTTCT | CAACCATCGA | GTCTCTTGGA |
| 1201 | ACGAAAACC | GCCCTGCAAG | GCGGTTTTT | CGTTTTCAGA | GCAAGAGATT |
| | TGCTTTTGG | CGGACGTTT | CGCCAAAAA | GCAAAAGTCT | CGTTCTCTAA |
| BgIII | | | | | |
| 1251 | ACGCGCAGAC | CAAACGATC | TCAAGAAGAT | CATCTTATTA | GATCTAGCAC |
| | TGCGCGTCTG | GTTTTGCTAG | AGTTCTTCTA | GTAGAATAAT | CTAGATCGTG |
| 1301 | CAGCGGTTTA | AGGCAACCAA | TAACTGCCCT | AAAAAATA | CGCCCCGCC |
| | GTCCGCAAAT | TCCCGTGGT | ATTGACGGAA | TTTTTTTAA | GCGGGCGGG |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|------|-------------|-------------|------------|-------------|-------------|
| 1351 | TGCCACTCAT | CGCAGTACTG | TTGTAATTCA | TTAAGCATTC | TGCCGACATG |
| | ACGGTGAGTA | GCGTCATGAC | AACATTAAGT | AATTCGTAAG | ACGGCTGTAC |
| 1401 | GAAGCCATCA | CAAACGGCAT | GATGAACCTG | AATCGCCAGC | GGCATCAGCA |
| | CTTCGGTAGT | GTTTGCCGTA | CTACTTGAC | TTAGCGGTG | CCGTAGTCGT |
| 1451 | CCTTGTCGCC | TTGCGTATAA | TATTTGCCCA | TAGTGAAAC | GGGGCGAAG |
| | GGAACAGCGG | AACGCATATT | ATAAACGGGT | ATCACTTTTG | CCCCCGCTTC |
| 1501 | AAGTTGTCCA | TATTGGCTAC | GTTTAAATCA | AAACTGGTGA | AACTCACCCA |
| | TTCAACACAGT | ATAACCGATG | CAAAATTAGT | TTTGACCACT | TTGAGTGGGT |
| 1551 | GGGATTGGCT | GAGACGAAA | ACATATTCTC | AATAAACCCCT | TTAGGGAAAT |
| | CCCTAACCGA | CTCTGCTTTT | TGTATAAGAG | TTATTTGGGA | AATCCCTTTA |
| 1601 | AGGCCAGGTT | TTCAACCGTAA | CACGCCACAT | CTTGCGAATA | TATGTGTAGA |
| | TCCGGTCCAA | AAGTGGCATT | GTGCGGTGTA | GAACGCTTAT | ATACACATCT |
| 1651 | AACTGCCCGA | AATCGTCGTG | GTATTCACTC | CAGAGCGATG | AAAACGTTC |
| | TTGACGGCCT | TTAGCAGCAC | CATAAGTGAG | GTCTCGCTAC | TTTTTGCAAAG |
| 1701 | AGTTTGCTCA | TGGAAAACGG | TGTAACAAGG | GTGAACACTA | TCCCATATCA |
| | TCAAACGAGT | ACCTTTTGCC | ACATTGTTCC | CACCTGTGAT | AGGGTATAGT |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

| | | | | | |
|------|-------------|-------------|-------------|-------------|------------|
| 1751 | CCAGCTCACC | GTCTTTCATT | GCCATACGGA | ACTCCGGGTG | AGCATTCATC |
| | GGTCGAGTGG | CAGAAAGTAA | CGGTATGCCT | TGAGGCCCCAC | TCGTAAGTAG |
| 1801 | AGCGGGGCAA | GAATGTGAAT | AAAGGCCGGA | TAAAACTTGT | GCTTATTTTT |
| | TCCGCCCGTT | CTTACACTTA | TTTCCGGCCT | ATTTTGAACA | CGAATAAAAA |
| 1851 | CTTTACGGTC | TTTAAAAAGG | CCGTAATATC | CAGCTGAACG | GTCTGGTTAT |
| | GAAATGCCAG | AAATTTTCC | GGCATTATAG | GTCGACTTGC | CAGACCAATA |
| 1901 | AGGTACATTG | AGCAACTGAC | TGAAATGCCT | CAAAATGTTT | TTTACGATGC |
| | TCCATGTAA | TCGTTGACTG | ACTTTACGGA | GTTTACAAAG | AAATGCTACG |
| 1951 | CATTGGGATA | TATCAACGGT | GGTATATCCA | GTGATTTTTT | TCTCCATTTT |
| | GTAACCCCTAT | ATAGTTGCCA | CCATATAGGT | CACTAAAAAA | AGAGGTAAAA |
| 2001 | AGCTTCCTTA | GCTCCTGAAA | ATCTCGATAA | CTCAAAAAAT | ACGCCCGGTA |
| | TCGAAGGAAT | CGAGGACTTT | TAGAGCTATT | GAGTTTTTTA | TGCGGGCCAT |
| 2051 | GTGATCTTAT | TTCAATTATGG | TGAAAGTTGG | AACCTCACCC | GACGTCTAAT |
| | CACTAGAATA | AAGTAATACC | ACTTCAACC | TTGGAGTGGG | CTGCAGATTA |
| 2101 | GTGAGTTAGC | TCACTCATTA | GGCACCCCCAG | GCTTTACACT | TTATGCTTCC |

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

	CACTCAATCG	AGTGAGTAAT	CCGTGGGGTC	CGAAATGTGA	AATACGAAGG
2151	GGCTCGTATG	TTGTGTGGAA	TTGTGAGCGG	ATAACAATTT	CACACAGGAA
	CCGAGCATAC	AACACACCTT	AACACTCGCC	TATTGTTAAA	GTGTGTCCTT
		XbaI		SphI	
		~~~~~		~~~~~	
2201	ACAGCTATGA	CCATGATTAC	GAATTTCTAG	ACCCCCCCC	CGCATGCCAT
	TGTCGATACT	GGTACTAATG	CTTAAAGATC	TGGGGGGGGG	GCGTACGGTA
			HindIII		
			~~~~~		
2251	AACTTCGTAT	AATGTACGCT	ATACGAAGTT	ATAAGCTTGA	CCTGTGAAGT
	TTGAAGCATA	TTACATGCGA	TATGCTTCAA	TATTCGAACT	GGACACTTCA
				PacI	
				~~~~~	
2301	GAAAAATGCG	GCAGATTGTG	CGACATTTT	TTTGTCTGCC	GTTTAATTAA
	CTTTTACC	CGTCTAACAC	GCTGTAAAAA	AAACAGACGG	CAAATTAAAT
		FseI			
		~~~~~			
2351	GGGGGGGGGC	CGGCCATTAT	CAAAAAGGAT	CTCAAGAAGA	TCCTTTGATC
	CCCCCCCCCG	GCCGGTAATA	GTTTTTCCCTA	GAGTTCCTCT	AGGAAACTAG

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

2401	TTTTCTACGG	GGTCTGACGC	TCAGTGGAAC	GAAACTCAC	GTAAAGGGAT
	AAAAGATGCC	CCAGACTGCG	AGTCACCTTG	CTTTTGAGTG	CAATTCCCTA
2451	TTTGGTCATG	AGATTATCAA	AAAGGATCTT	CACCTAGATC	CTTTTAAATT
	AAACCAGTAC	TCTAATAGTT	TTTCCTAGAA	GTGGATCTAG	GAAATTTAA
2501	AAAATGAAG	TTTTAAATCA	ATCTAAAGTA	TATATGAGTA	AACTTGGTCT
	TTTTTACTTC	AAAATTTAGT	TAGATTTTCAT	ATATACTCAT	TTGAACCAGA
2551	GACAGTTACC	CAATGCTTAA	TCAGTGAGGC	ACCTATCTCA	GCGATCTGTC
	CTGTCAATGG	GTTACGGAATT	AGTCACTCCG	TGGATAGAGT	CGCTAGACAG
2601	TATTTCGTC	ATCCATAGTT	GCCTGACTCC	CCGTCGTGTA	GATAACTACG
	ATAAGCAAG	TAGGTATCAA	CGGACTGAGG	GGCAGCACAT	CTATTGATGC
2651	ATACGGGAGG	GCTTACCATC	TGGCCCCAGT	GCTGCAATGA	TACCGCGAGA
	TATGCCCTCC	CGAATGGTAG	ACCGGGGTCA	CGACGTTACT	ATGGCGCTCT
2701	CCCACGCTCA	CCGGCTCCAG	ATTATCAGC	AATAAACCCAG	CCAGCCGGAA
	GGGTGCGAGT	GGCCGAGGTC	TAAATAGTCG	TTATTGGTC	GGTCGGCCCT
2751	GGGCCGAGCG	CAGAAGTGGT	CCTGCAACTT	TATCCGCCCTC	CATCCAGTCT
	CCCGGCTCGC	GTCTTCACCA	GGACGTTGAA	ATAGCGGAG	GTAGGTCAGA

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

2801	ATTAACCTGTT	GCCGGGAAGC	TAGAGTAAGT	AGTTCGCCAG	TTAATAGTTT
	TAATTGACAA	CGGCCCTTCG	ATCTCATTTCA	TCAAGCGGTC	AATTATCAAA
2851	GCGCAACGTT	GTTGCCATTG	CTACAGGCAT	CGTGGTGTCA	CGCTCGTCGT
	CGCGTTGCAA	CAACGGTAAC	GATGTCCGTA	GCACCACAGT	GCGAGCAGCA
2901	TTGGTATGGC	TTCAATTCAGC	TCCGGTTCCC	AACGATCAAG	GCGAGTTACA
	AACCATACCG	AAGTAAAGTCG	AGGCCAAGGG	TTGCTAGTTC	CGCTCAATGT
2951	TGATCCCCCA	TGTTGTGCAA	AAAAGCGGTT	AGCTCCTTCG	GTCCCTCCGAT
	ACTAGGGGGT	ACAACACGTT	TTTTTCGCCAA	TCGAGGAAGC	CAGGAGGCTA
3001	CGTTGTCAGA	AGTAAAGTTGG	CCGCAGTGTT	ATCACTCATG	GTTATGGCAG
	GCAACAGTCT	TCATTCAACC	GGCGTCACAA	TAGTGAGTAC	CAATACCGTC
3051	CACTGCATAA	TTCTCTTACT	GTCAATGCCAT	CCGTAAGATG	CTTTTCTGTG
	GTGACGTATT	AAGAGAAATGA	CAGTACGGTA	GGCATTCTAC	GAAAAGACAC
3101	ACTGGTGAGT	ACTCAACCAA	GTCAATTCTGA	GAATAGTGTA	TGCGGCGGACC
	TGACCACTCA	TGAGTTGGTT	CAGTAAGACT	CTTATCACAT	ACGCCGCTGG
3151	GAGTTGCTCT	TGCCCCGGCGT	CAATACGGGA	TAATACCGCG	CCACATAGCA
	CTCAACGAGA	ACGGGCCGCA	GTTATGCCCT	ATTATGGCGC	GGTGTATCGT

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

	XmnI	
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3201	GAAC TT TAAA AGTGCTCATC ATTGGAAAAC GTTCTTCGGG GCGAAACTC CTTGAAATTT TCACGAGTAG TAACCTTTTG CAAGAAGCCC CGCTTTTGAG	
3251	TCAAGGATCT TACCGCTGTT GAGATCCAGT TCGATGTAAAC CCACTCGCGC AGTTCCCTAGA ATGGCGACAA CTCTAGGTCA AGCTACATTG GTGAGCGCG	
3301	ACCCAACTGA TCCTCAGCAT CTTTACTTT CACCAGCGTT TCTGGGTGAG TGGGTTGACT AGGAGTCGTA GAAATGAAA GTGGTCGCAA AGACCCACTC	
3351	CAAAACACAG AAGCAAAT GCCGCAAAA AGGGAATAAG GCGACACGG GTTTTTGTC TTCCGTTTTA CGCGTTTTT TCCCTTATTC CCGCTGTGCC	
3401	AAATGTTGAA TACTCATACT CTCCTTTT CAATATTAT GAAGCATTTA TTTACAACCTT ATGAGTATGA GAAGGAAAA GTTATAATAA CTTCGTAAAT	
	BsrGI	
3451	TCAGGGTTAT TGTCTCATGA GCGGATACAT ATTTGAAT AGTCCCAATA ACAGAGTACT CGCCTATGTA TAAACTTA	

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

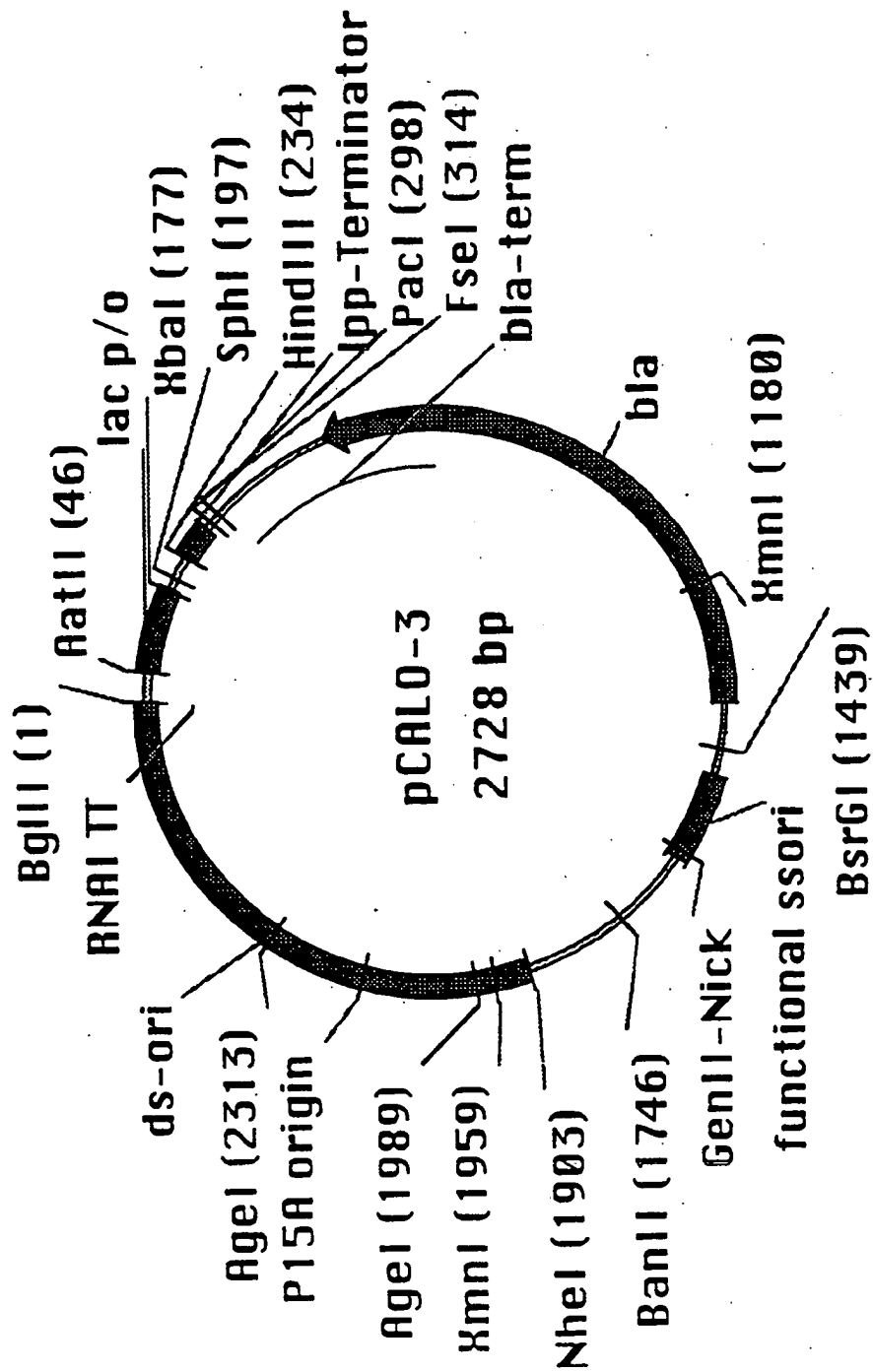


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCALO-3:		AatII	
	BglII		
	~~~~~	~~~~~	
1	GATCTCATAA CTTCGTATAA TGTATGCTAT ACGAAGTTAT GACGTCTAAT	CTAGAGTATT GAAGCATATT ACATACGATA TGCTTCAATA CTGCAGATTA	
51	GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT TTATGCTTCC	CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA AATACGAAGG	
101	GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATT CACACAGGAA	CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAA GTGTGTCCTT	
		XbaI	SphI
		~~~~~	~~~~~
151	ACAGCTATGA CCATGATTAC GAATTCTAG ACCCCCCCCC CGCATGCCAT	TGTCGATACT GGTAATAATG CTTAAAGATC TGGGGGGGGG GCGTACGGTA	
		HindIII	
		~~~~~	
201	AAC TTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA CCTGTGAAGT	TTGAAGCATA TTACATGCCA TATGCTTCAA TATTCGAACT GGACACTTCA	
			PacI

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

251	GAAAAATGGC GCAGATTGTG CGACATTTT TTTGTCTGCC GTTTAATTAA CTTTTACC CGTCTAACAC GCTGTAAAAA AACACAGACGG CAAATTAAAT	~~~~~
	FseI	
301	GGGGGGGGC CGCCATTAT CAAAAGGAT CTCAAGAAGA TCCTTTGATC CCCCCCCCG GCGGTAATA GTTTTTCCTA GAGTTCTTCT AGGAAACTAG	~~~~~
351	TTTTCTACGG GGTCTGACGC TCAGTGGAAC GAAAACCTCAC GTTAAGGGAT AAAAGATGCC CCAGACTGCG AGTCACCTTG CTTTGTGAGTG CAATTCCCCTA	
401	TTTGGTCATG AGATTATCAA AAAGGATCTT CACCTAGATC CTTTTAAATT AAACCAGTAC TCTAATAGTT TTTCCCTAGAA GTGGATCTAG GAAAAATTAA	
451	AAAAATGAAG TTTTAAATCA ATCTAAAGTA TATATGAGTA AACTTGGTCT TTTTTACTTC AAAATTTAGT TAGATTTCAT ATATACTCAT TTGAACCCAGA	
501	GACAGTTACC CAATGCTTAA TCAGTGAGGC ACCTATCTCA GCGATCTGTC CTGTCAATGG GTTACGGAATT AGTCACTCCG TGGATAGAGT CGCTAGACAG	
551	TATTTCGTTT ATCCATAGTT GCCTGACTCC CCGTCGTGTA GATAACTACG ATAAAGCAAG TAGGTATCAA CGGACTGAGG GGCAGCACAT CTATTGATGC	

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

601	ATACGGGAGG	GCTTACCATC	TGGCCCCCAGT	GCTGCAATGA	TACCGCGAGA
	TATGCCCTCC	CGAATGGTAG	ACCGGGGTCA	CGACGTTACT	ATGGCGCTCT
651	CCCACGCTCA	CCGGCTCCAG	ATTTATCAGC	AATAAACCCAG	CCAGCCGGAA
	GGTGCGAGT	GGCCGAGGTC	TAAATAGTCG	TTATTTGGTC	GGTCGGCCCTT
701	GGGCCGAGCG	CAGAAGTGGT	CCTGCAACTT	TATCCGCCCTC	CATCCAGTCT
	CCCGGCTCGC	GTCTTCACCA	GGACGTTGAA	ATAGCGCGAG	GTAGGTCAGA
751	ATTAACTGTT	GCCGGGAAGC	TAGAGTAAGT	AGTTCGCCCAG	TTAATAGTTT
	TAATTGACAA	CGGCCCTTCG	ATCTCATTCA	TCAAGCGGTC	AATTATCAAA
801	GCGCAACGTT	GTTGCCATTG	CTACAGGCAT	CGTGGTGTC	CGCTCGTCTG
	CGCGTTGCAA	CAACGGTAAC	GATGTCCGTA	GCACCACAGT	GCGAGCAGCA
851	TTGGTATGGC	TTCATTTCAGC	TCCGGTTCCC	AACGATCAAG	GCGAGTTACA
	AACCATAACCG	AAGTAAGTCG	AGGCCAAGGG	TTGCTAGTTC	CGCTCAATGT
901	TGATCCCCCA	TGTTGTGCAA	AAAAGCGGTT	AGTCCCTTCG	GTCCCTCCGAT
	ACTAGGGGGT	ACAACACGTT	TTTTTCGCCAA	TCGAGGAAGC	CAGGAGGCTA
951	CGTTGTCAGA	AGTAAGTTGG	CCGCAGTGTT	ATCACTCATG	GTTATGGCAG
	GCAACAGTCT	TCATTCAACC	GGCGTCACAA	TAGTGAGTAC	CAATACCGTC

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

1001	CACTGCATAA TTCTCTTACT GTCATGCCAT CCGTAAGATG CTTTCTGTG GTGACGTATT AAGAGAAATGA CAGTACGGTA GGCATTCTAC GAAAAGACAC
1051	ACTGGTGAGT ACTCAACCAA GTCATTTCTGA GAATAGTGTA TCGGGCGACC TGACCACTCA TGAGTTGGTT CAGTAAGACT CTTATCACAT ACGCCGCTGG
1101	GAGTTGCTCT TGCCCGGCGT CAATACGGGA TAATACCGCG CCACATAGCA CTCAACGAGA ACGGCCGCA GTTATGCCCT ATTATGGCGC GGTGTATCGT
XmnI ~~~~~	
1151	GAACTTTAAA AGTGCTCATC ATTGGAAAAC GTTCTTCGGG GCGAAAAC TC CTTGAAAATT TCACGAGTAG TAACCTTTTG CAAGAAGCCC CGCTTTTGAG
1201	TCAAGGATCT TACCGCTGTT GAGATCCAGT TCGATGTAAC CCACTCGCGC AGTTCCTAGA ATGGCGACAA CTCTAGGTCA AGCTACATTG GGTGAGCGCG
1251	ACCCAAC TGA TCCCTCAGCAT CTTTACTTT CACCAGCGTT TCTGGGTGAG TGGGTTGACT AGGAGTCGTA GAAAATGAAA GTGGTCGCAA AGACCCACTC
1301	CAAAAACAGG AAGGCAAAAT GCCGCAAAA AGGGAATAAG GCGACACGG GTTTTTGTCC TTCCGTTTTA CGCGTTTTT TCCCTTATTC CCGCTGTGCC
1351	AAATGTTGAA TACTCATACT CTTCCTTTTT CAATATTATT GAAGCATTTA

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Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

	TTTACAACCTT	ATGAGTATGA	GAAGGAAAAA	GTTATAATAA	CTTCGTAAAT
	BsrGI				
	~~~~~				
1401	TCAGGGTTAT	TGTCTCATGA	CGGATACAT	ATTTGAATGT	ACATGAAATT
	AGTCCCAATA	ACAGAGTACT	CGCCTATGTA	TAAACTTACA	TGTACTIONTAA
1451	GTAACGTTA	ATATTTTGT	AAAATTCGCG	TTAAATTTT	GTTAAATCAG
	CATTTGCAAT	TATAAAACAA	TTTTAAGCGC	AATTTAAAAA	CAATTTAGTC
1501	CTCATTTTTT	AACCAATAGG	CCGAAATCGG	CAAAATCCCT	TATAAATCAA
	GAGTAAAAAA	TTGGTTATCC	GGCTTTAGCC	GTTTTAGGGA	ATATTTAGTT
1551	AAGAATAGAC	CGAGATAGGG	TTGAGTGTTG	TTCCAGTTTG	GAACAAGAGT
	TTCTTATCTG	GCTCTATCCC	AACTCACAAC	AAGGTCAAAC	CTTGTTCTCA
1601	CCACTATTAA	AGAACGTGGA	CTCCAACGTC	AAAGGGCGAA	AAACCGTCTA
	GGTGATAATT	TCTTGACACCT	GAGGTTGCAG	TTTCCCCTT	TTTGGCAGAT
1651	TCAGGGCGAT	GGCCCACTAC	GAGAACCATC	ACCCTAATCA	AGTTTTTTGG
	AGTCCCCTA	CCGGGTGATG	CTCTTGGTAG	TGGGATTAGT	TCAAAAAAAC

BanII
~~~~~

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

|      |                                                                                                                 |       |
|------|-----------------------------------------------------------------------------------------------------------------|-------|
| 1701 | GGTCGAGGTG CCGTAAAGCA CTAATCGGA ACCCTAAAGG GAGCCCCCGA<br>CCAGCTCCAC GGCATTTCGT GATTAGCCT TGGGATTTC CTCGGGGGCT   |       |
| 1751 | TTTAGAGCTT GACGGGAA GCGGCGAAC GTGGCGAGAA AGGAAGGAA<br>AAATCTCGAA CTGCCCTTT CCGCGCTTG CACCGCTCTT TCCTTCCCTT      |       |
| 1801 | GAAAGCGAAA GGAGCGGGCG CTAGGGCGCT GGCAAGTGA GCGTCAACG<br>CTTTCGCTTT CCTCGCCCGC GATCCCGCGA CCGTTCACAT CGCCAGTGCG  |       |
| 1851 | TGCGCGTAAC CACCACACCC GCCGCGCTTA ATGCGCCGCT ACAGGCGCG<br>ACGCGCATTG GTGGTGTGG CGCGCGGAAT TACGCGGCGA TGTCCCGCGC  |       |
|      | NheI                                                                                                            |       |
|      | ~~~~~                                                                                                           |       |
| 1901 | TGCTAGCGGA GTGTATACTG GCTTACTATG TTGGCACTGA TGAGGTGTC<br>ACGATCGCCT CACATATGAC CGAATGATAC AACCGTGACT ACTCCCACAG |       |
|      | XmnI                                                                                                            |       |
|      | ~~~~~                                                                                                           |       |
| 1951 | AGTGAAGTGC TTCATGTGGC AGGAGAAAA AGGCTGCACC GGTGCGTCAG<br>TCACTTCACG AAGTACACCG TCCTCTTTT TCCGACGTGG CCACGCAGTC  | AgeI  |
|      |                                                                                                                 | ~~~~~ |
| 2001 | CAGAATATGT GATACAGGAT ATATTCCGCT TCCTCGCTCA CTGACTCGCT<br>GTCTTATACA CTATGTCCTA TATAAGCGA AGGAGCGAGT GACTGAGCGA |       |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

|               |                                                                                                                   |
|---------------|-------------------------------------------------------------------------------------------------------------------|
| 2051          | ACGCTCGGTC GTTCGACTGC GCGAGCGGA AATGGCTTAC GAACGGGGCG<br>TGCAGCCAG CAAGCTGACG CCGCTCGCCT TTACCGAATG CTTGCCCCCGC   |
| 2101          | GAGATTTCCT GGAAGATGCC AGGAAGATAC TTAACAGGGA AGTGAGAGGG<br>CTCTAAAGGA CCTTCTACGG TCCTTCTATG AATTGTCCCT TCACTCTCCC  |
| 2151          | CCGCGGCAAA GCCGTTTTC CATAGGCTCC GCCCCCCTGA CAAGCATCAC<br>GGCGCCGTTT CGGCAAAAG GTATCCGAGG CGGGGGACT GTTCGTAGTG     |
| 2201          | GAAATCTGAC GCTCAAATCA GTGGTGGCGA AACCCGACAG GACTATAAAG<br>CTTTAGACTG CGAGTTTAGT CACCACCGCT TTGGGCTGTC CTGATATTTC  |
| 2251          | ATACCAGGCG TTTCCCCCTG GCGGCTCCCT CCTGCGCTCT CCTGTTCCCTG<br>TATGGTCCGC AAAGGGGGAC CGCCGAGGGA GGACGCGAGA GGACAAGGAC |
| AgeI<br>~~~~~ |                                                                                                                   |
| 2301          | CCTTTCGGTT TACCGGTGTC ATCCGCTGT TATGGCCGCG TTTGTCTCAT<br>GGAAAGCCAA ATGCCACAG TAAGCGACA ATACCGGCGC AACAGAGTA      |
| 2351          | TCCACGCCCTG AACTCAGTT CCGGGTAGGC AGTTCGCTCC AAGCTGGACT<br>AGGTGCGGAC TGTGAGTCAA GGCCCATCCG TCAAGCGAGG TTCGACCTGA  |

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

|       |            |             |             |            |            |
|-------|------------|-------------|-------------|------------|------------|
| 2401  | GTATGCACGA | ACCCCCCGTT  | CAGTCCGACC  | GCTGCGCCTT | ATCCGGTAAC |
|       | CATACGTGCT | TGGGGGGCAA  | GTCAGGCTGG  | CGACGCGGAA | TAGGCCATTC |
| 2451  | TATCGTCTTG | AGTCCAACCC  | GGAAAGACAT  | GCAAAAGCAC | CACTGGCAGC |
|       | ATAGCAGAAC | TCAGGTGGG   | CCTTCTCTGA  | CGTTTTCGTG | GTGACCGTCG |
| 2501  | AGCCACTGGT | AATTGATTTA  | GAGGAGTTAG  | TCTTGAAGTC | ATGCGCCGGT |
|       | TCGGTGACCA | TTAACTAAAT  | CTCCTCAATC  | AGAACTTCAG | TACGCGGCCA |
| 2551  | TAAGGCTAAA | CTGAAAGGAC  | AAGTTTTAGT  | GACTGCGCTC | CTCCAAGCCA |
|       | ATTCCGATT  | GACTTTCCCTG | TTCAAAATCA  | CTGACGCGAG | GAGGTTCCGT |
| 2601  | GTTACCTCGG | TTCAAAGAGT  | TGGTAGCTCA  | GAGAACCTAC | GAAAAACCGC |
|       | CAATGGAGCC | AAGTTTCTCA  | ACCATCGAGT  | CTCTTGGATG | CTTTTGGCG  |
| 2651  | CCTGCAAGGC | GGTTTTCG    | TTTTTCAGAGC | AAGAGATTAC | GCGCAGACCA |
|       | GGACGTTCCG | CCAAAAAAGC  | AAAAGTCTCG  | TTCTCTAATG | CGCGTCTGGT |
| Bg111 |            |             |             |            |            |
| 2701  | AAACGATCTC | AAGAAGATCA  | TCTTATTA    |            |            |
|       | TTTGCTAGAG | TTCTTCTAGT  | AGAATAAT    |            |            |

Figure 35b: List of oligonucleotides used for synthesis of modules

M1: PCR using template

NoVspAatII: TAGACGTC

M2: synthesis

BloxA-A: TATGAGATCTCATAACTTCGTATAATGTACGCTATACG-  
AAGTTAT

BloxA-B: TAATAACTTCGTATAGCATAACATTATACGAAGTTATG-  
AGATCTCA

M3: PCR, NoVspAatII as second oligo

XloxS-muta: CATTTTTGCCCTCGTTATCTACGCATGCGATAACTTCGTA-  
TAGCGTACATTATACGAAGTTATTCTAGACATGGTCATAGCTGTTTCCTG

M7-I: PCR

gIII NEW-fow: GGGGGGAATTCGGTGGTGGTGGATCTGCGTGCGCTG-  
AAACGGTTGAAAGTTG

gIII NEW-rev: CCCCCCAAGCTTATCAAGACTCCTTATTACG

M7-II: PCR

gIII ss-fow: GGGGGGGGAATTCGGAGGCGGTTCCGGTGGTGGC

M7-III: PCR

gIII supernew-fow: GGGGGGGGAATTCGAGCAGAAGCTGATCTCT-  
GAGGAGGATCTGTAGGGTGGTGGCTCTGGTTCCGGTGATTTG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

**M8: synthesis**

lox514-A: CCATAACTTCGTATAATGTACGCTATACGAAGTTATA

lox514-B: AGCTTATAACTTCGTATAGCGTACATTATACGAAGT-  
TATGGCATG

**M9II: synthesis**

M9II-fow: AGCTTGACCTGTGAAGTGAAAAATGGCGCAGATT-  
GTGCGACATTTTTTTTGTCTGCCGTTTAATTAAAGGGGGGGT

M9II-rev: GTACACCCCCCCCCAGGCCGGCCCCCCCCCCCCCTTTAA-  
TTAAACGGCAGACAAAAAAAATGTCGCACAATCTGCG

**M10II: assembly PCR with template**

bla-fow: GGGGGGGTGTACATTCAAATATGTATCCGCTCATG

bla-seq4: GGGTTACATCGAACTGGATCTC

bla1-muta: CCAGTTCGATGTAACCCACTCGCGCACCCAACTGATC-  
CTCAGCATCTTTACTTTCACC

blaII-muta: ACTCTAGCTTCCCGGCAACAGTTAATAGACTGGATG-  
GAGGCGG

bla-NEW: CTGTTGCCGGGAAGCTAGAGTAAG

bla-rev: CCCCCCTTAATTAAGGGGGGGGGCCGGCCATTATCAAA-  
AAGGATCTCAAGAAGATCC

**M11II/III: PCR, site-directed mutagenesis**

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

f1-fow: GGGGGGGGCTAGCACGCGCCCTGTAGCGGCGCATTA

f1-rev: CCCCCCTGTACATGAAATTGTAAACGTTAATATTTG

f1-t133.muta: GGGCGATGGCCCACTACGAGAACCATCACCTAATC

### M12: assembly PCR using template

p15-fow: GGGGGGAGATCTAATAAGATGATCTTCTTGAG

p15-NEWI: GAGTTGGTAGCTCAGAGAACCTACGAAAAACCGCCCTG-  
CAAGGCG

p15-NEWII: GTAGGTTCTCTGAGCTACCAACTC

p15-NEWIII: GTTCCCCCTGGCGGCTCCCTCCTGCGCTCTCCTGTTCT-  
GCC

p15-NEWIV: AGGAGGGAGCCGCCAGGGGGGAAAC

p15-rev: GACATCAGCGCTAGCGGAGTGTATAC

### M13: synthesis

BloxXB-A: GATCTCATAACTTCGTATAATGTATGCTATACGAAGTTA-  
TTCA

BloxXB-B: GATCTGAATAACTTCGTATAGCATACATTATACGAAGTTA-  
TGAGA

### M14-Ext2: PCR, site-directed mutagenesis

ColEXT2-fow: GGGGGGGGAGATCTGACCAAATCCCTTAACGTGAG

Col-mutal: GGTATCTGCGCTCTGCTGTAGCCAGTTACCTTCGG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

Col-rev: CCCCCCGCTAGCCATGTGAGCAAAAGGCCAGCAA

M17: assembly PCR using template

CAT-1: GGGACGTCGGGTGAGGTCCAAC

CAT-2: CCATACGGAACCTCCGGGTGAGCATTATC

CAT-3: CCGGAGTTCCGTATGG

CAT-4: ACGTTTAAATCAAACTGG

CAT-5: CCAGTTTTGATTTAAACGTAGCCAATATGGACAACCTCTTC-  
GCCCCCGTTTTCACTATGGGCAAATATT

CAT-6: GGAAGATCTAGCACCAGGCGTTTAAG

M41: assembly PCR using template

LAC1: GAGGCCGGCCATCGAATGGCGCAAAAC

LAC2: CGCGTACCGTCCTCATGGGAGAAAATAATAC

LAC3: CCATGAGGACGGTACGCGACTGGGCGTGGAGCATCTGGTCGCA-  
TTGGGTCACCAGCAAATCCGCTGTTAGCTGGCCCATTAAG

LAC4: GTCAGCGGCGGGATATAACATGAGCTGTCCTCGGTATCGTCG

LAC5: GTTATATCCCGCCGCTGACCACCATCAAAC

LAC6: CATCAGTGAATCGGCCAACGCGCGGGGAGAGGCGGTTTGCGT4TTG-  
GGAGCCAGGGTGGTTTTTC

LAC7: GGTTAATTAACCTCACTGCCCCGCTTTCCAGTCGGGAAACCTGTCGTGCC-  
AGCTGCATCAGTGAATCGGCCAAC

M41-MCS-fow: CTAGACTAGTGTTTAAACCGGACCGGGGGGGGGGCTT-  
AAGGGGGGGGGGGGGG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

M41-MCS-rev: CTAGCCCCCCCCCCTTAAGCCCCCCCCCGGTCCGGT-  
TTAAACACTAGT

M41-fow: CTAGACTAGTGTTTAAACGGACCGGGGGGGGGCTTAA-  
GGGGGGGGGGGGG

M41-rev: CCCCCCTTAAGTGGGCTGCAAAACAAAACGGCCTCC-  
TGTCAGGAAGCCGCTTTTATCGGGTAGCCTCACTGCCCGCTTCC

M41-A2: GTTGTTGTGCCACGCGGTTAGGAATGTAATTCAGCTCCGC

M41-B1: AACCGCGTGGCACAACAAC

M41-B2: CTCGTTCTACCATCGACACGACCACGCTGGCACCCAGTTG

M41-C1: GTGTCGATGGTAGAACGAAG

M41-CII: CCACAGCAATAGCATCCTGGTCATCCAGCGGATAGTT-  
AATAATCAGCCCCTGACACGTTGCGCGAG

M41-DI: GACCAGGATGCTATTGCTGTGG

M41-DII: CAGCGCGATTGCTGGTGGCCCAATGCGACCAGATGC

M41-EI: CACCAGCAAATCGCGCTG

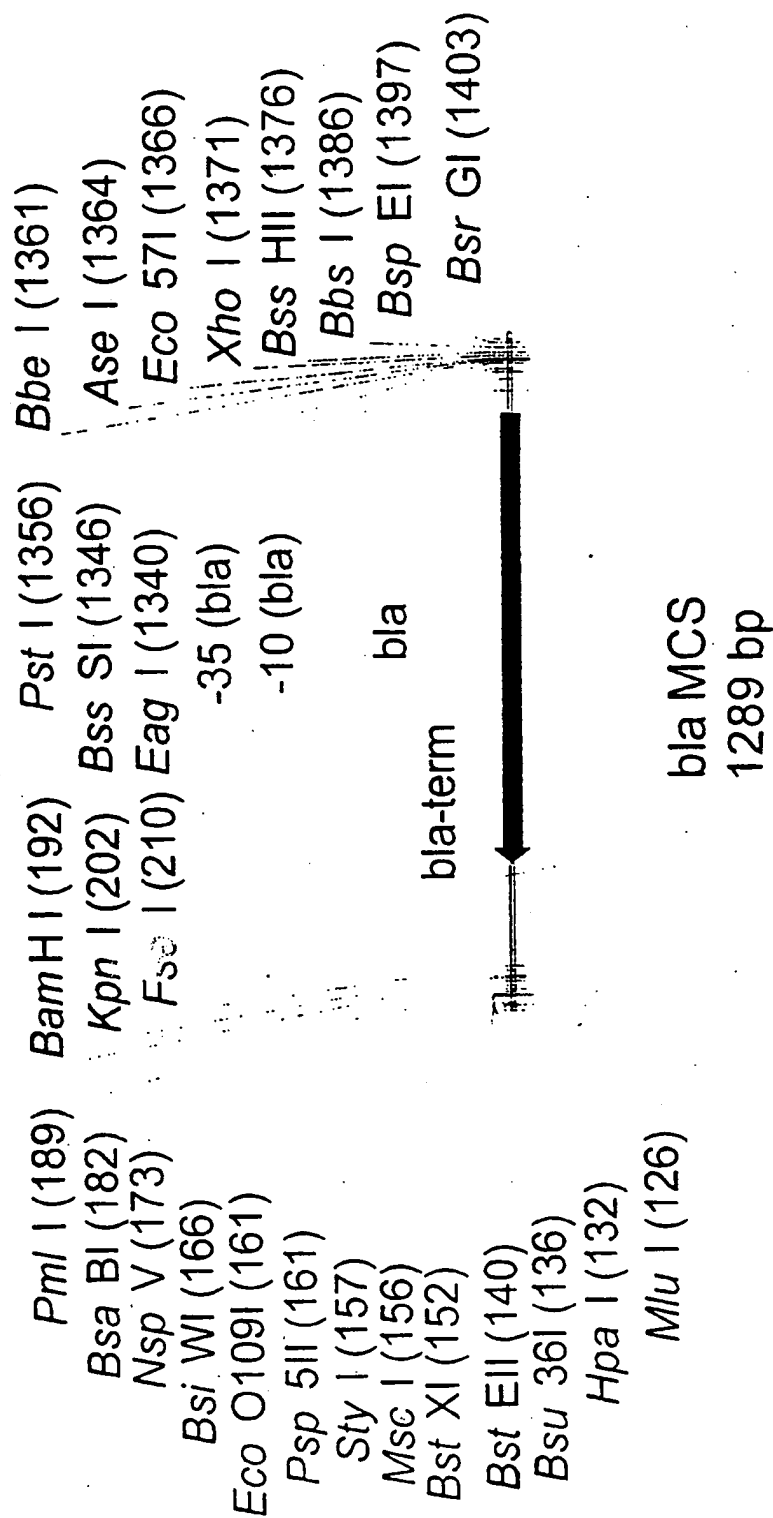
M41-EII: CCCGGACTCGGTAATGGCACGCATTGCGCCCAGCGCC

M41-FI: GCCATTACCGAGTCCGGG

#### M42: synthesis

Eco-H5-Hind-fow: AATTCCACCATCATCACCATTGACGTCTA

Eco-H5-Hind-rev: AGCTTAGACGTCAATGGTGATGATGGTGG

Figure 36: functional map and sequence of  $\beta$ -lactamase-MCS module

[illegible][illegible]

Figure 36: functional map and sequence of  $\beta$ -lactamase-MCS module (continued)

|     |                                                        |                                                          |
|-----|--------------------------------------------------------|----------------------------------------------------------|
| 326 | TCACCTAGAT CCTTTTAAAT TAAAAATGAA GTTTTAAATC AATCTAAAGT | AGTGGATCTA GGAATAATTA ATTTTACTT CAAAATTAG TTAGATTTC      |
| 376 | ATATATGAGT AAACCTGGTC TGACAGTTAC CAATGCTTAA TCAGTGAGGC | TATATACTCA TTTGAACCAG ACTGTCAATG GTTACGAATT AGTCACTCCG   |
| 426 | ACCTATCTCA GCGATCTGTC TATTTCGTTT ATCCATAGTT GCCTGACTCC | TGGATAGAGT CGCTAGACAG ATAAAGCAAG TAGGTATCAA CGGACTGAGG   |
| 476 | CCGTCGTGTA GATAACTACG ATACGGGAGG GCTTACCATC TGGCCCCAGT | GGCAGCACAT CTATTGATGC TATGCCCCCTCC CGAATGGTAG ACCGGGGTCA |
| 526 | GCTGCAATGA TACCGCGAGA CCCACGCTCA CCGGCTCCAG ATTTATCAGC | CGACGTTACT ATGGCGCTCT GGTGCGAGT GGCCGAGGTC TAAATAGTCCG   |
| 576 | AATAAACCAG CCAGCCGGAA GGGCCGAGCG CAGAAGTGGT CCTGCAACTT | TTATTGGTC GGTCGGCCTT CCCGGCTCGC GTCTTCACCA GGACGTTGAA    |
| 626 | TATCCGCCCTC CATCCAGTCT ATTAAGTGT GCGGGGAAGC TAGAGTAAGT | ATAGGCGGAG GTAGGTCAGA TAATTGACAA CGGCCCTTCG ATCTCATTCA   |
| 676 | AGTTCGCCAG TTAATAGTTT GCGCAACGTT GTTGCCATTG CTACAGGCAT | TCAAGCGGTC AATTATCAAA CGCGTTGCAA CAACGGTAAC GATGTCCGTA   |

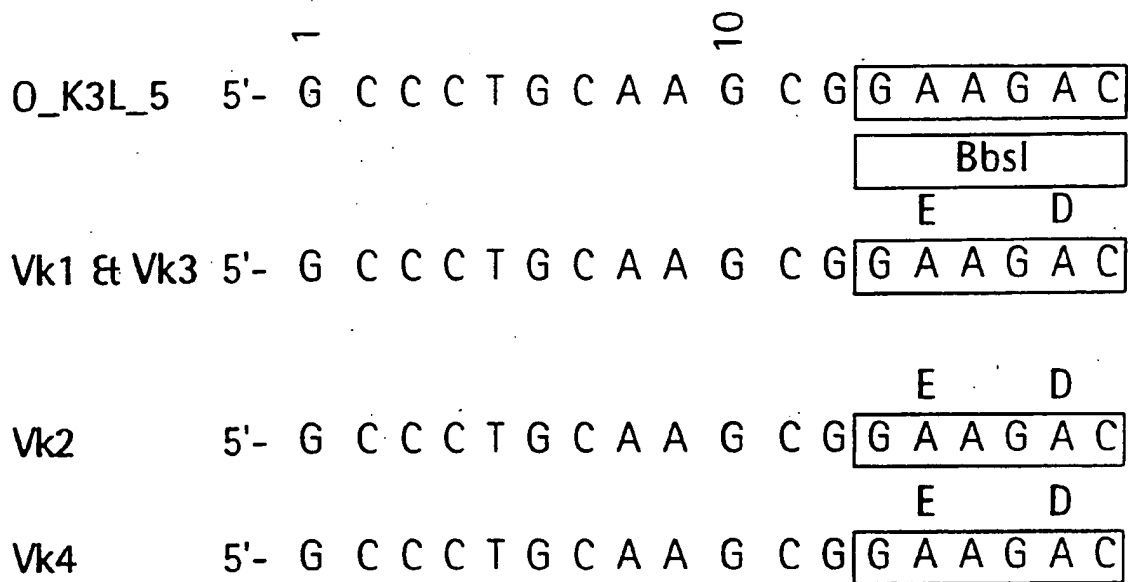
Figure 36: functional map and sequence of  $\beta$ -lactamase-MCS module (continued)

|      |            |             |              |            |             |
|------|------------|-------------|--------------|------------|-------------|
| 726  | CGTGGTGTCA | CGCTCGTCGT  | TTGGTATGGC   | TTCATTACGC | TCCGGTTCCC  |
|      | GCACCACAGT | GCGAGCAGCA  | AACCATACCG   | AAGTAAGTCG | AGGCCAAGGG  |
| 776  | AACGATCAAG | GCGAGTTACA  | TGATCCCCCA   | TGTTGTGCAA | AAAAGCGGTT  |
|      | TTGCTAGTTC | CGCTCAATGT  | ACTAGGGGGT   | ACAACACGTT | TTTTTCGCCAA |
| 826  | AGCTCCTTCG | GTCCCTCCGAT | CGTTGTCAGA   | AGTAAGTTGG | CCGCAGTGTT  |
|      | TCGAGGAAGC | CAGGAGGCTA  | GCAACAGTCT   | TCATTCAACC | GGCGTCACAA  |
| 876  | ATCACTCATG | GTTATGGCAG  | CACTGCATAA   | TTCTCTTACT | GTCATGCCAT  |
|      | TAGTGAGTAC | CAATACCGTC  | GTGACGTATT   | AAGAGAATGA | CAGTACGGTA  |
| 926  | CCGTAAGATG | CTTTTCTGTG  | ACTGGTGAGT   | ACTCAACCAA | GTCATTCTGA  |
|      | GGCATTCTAC | GAAAGACAC   | TGACCACTCA   | TGAGTTGGTT | CAGTAAGACT  |
| 976  | GAATAGTGT  | TGCGGCGACC  | GAGTTGCTCT   | TGCCCGGCGT | CAATACGGGA  |
|      | CTTATCACAT | ACGCCGCTGG  | CTCAACGAGA   | ACGGGCCGCA | GTTATGCCCT  |
| 1026 | TAATACCGCG | CCACATAGCA  | GAAC TT TAAA | AGTGCTCATC | ATTGGAAAAC  |
|      | ATTATGGCGC | GGTGATCCGT  | CTTGAAATTT   | TCACGAGTAG | TAACCTTTTG  |
| 1076 | GTTCTTCGGG | GCGAAAAC TC | TCAAGGATCT   | TACCGCTGTT | GAGATCCAGT  |
|      | CAAGAAGCCC | CGCTTTTGAG  | AGTTCCTAGA   | ATGGCGACAA | CTCTAGGTCA  |

[illegible][illegible]

Figure 36: functional map and sequence of  $\beta$ -lactamase-MCS module (continued)

|      |            |            |            |            |
|------|------------|------------|------------|------------|
| 1376 | CGCGCTTCAG | CGCTTTGTCT | TCCGGATGTA | CATGAAATT  |
|      | GCGCGAAGTC | GCGAAACAGA | AGGCCTACAT | GTACTTTTAA |
|      | ECO57I     | BbsI       | ~~~~~      | ~~~~~      |

Figure 37: Oligo and primer design for V<sub>κ</sub> CDR3 libraries

|     |    |   |           |   |    |   |   |   |   |   |   |   |   |   |   |   |    |    |
|-----|----|---|-----------|---|----|---|---|---|---|---|---|---|---|---|---|---|----|----|
| -3' | 20 |   | 30        |   | 40 |   |   |   |   |   |   |   |   |   |   |   |    |    |
|     | F  | A | <b>IV</b> | Y | Y  | C | Q |   |   |   |   |   |   |   |   |   |    |    |
| T   | T  | T | G         | C | G  | A | C | T | A | T | T | A | T | T | G | C | CA |    |
|     | V  | G | V         | Y | Y  | C |   |   |   |   |   |   |   |   |   |   |    |    |
| G   | T  | G | G         | G | C  | G | T | G | T | A | T | T | A | T | T | G | C  | CA |
|     | V  | A | V         | Y | Y  | C |   |   |   |   |   |   |   |   |   |   |    |    |
| G   | T  | G | G         | C | G  | G | T | G | T | A | T | T | A | T | T | G | C  | CA |

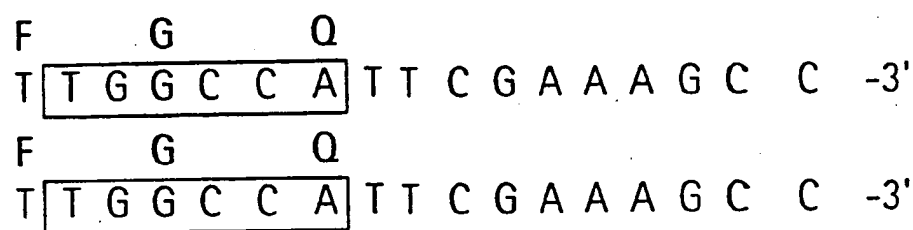
|       |       |
|-------|-------|
| A     |       |
| C     |       |
| D     |       |
| E     |       |
| F     | T T T |
| G     |       |
| H     | C A T |
| I     |       |
| K     |       |
| L     | C T T |
| M     | A T G |
| N     |       |
| P     |       |
| Q     | C A G |
| R     |       |
| S     |       |
| T     |       |
| V     |       |
| W     |       |
| Y     |       |
| 80% Q |       |

Figure 37: Oligo and primer design for V $\kappa$  CDR3 libraries

|       |       |       |       |       |       |           |  |
|-------|-------|-------|-------|-------|-------|-----------|--|
|       |       |       | 50    |       |       | 60        |  |
|       |       |       |       |       |       | 3'- G G A |  |
|       |       |       |       |       |       | T         |  |
| G     |       |       |       |       |       | A C C T   |  |
|       |       |       |       |       |       | T         |  |
| G     |       |       |       |       |       | A C C T   |  |
|       |       |       |       |       |       | T         |  |
| G     |       |       |       |       |       | A C C T   |  |
| G C T |       |       | G C T |       | G C T |           |  |
| G A T | G A T | G A T | G A T |       | G A T |           |  |
| G A G |       |       | G A G |       | G A G |           |  |
| T T T |       |       | T T T |       | T T T |           |  |
| G G T | G G T | G G T | G G T |       | G G T |           |  |
| C A T |       |       | C A T |       | C A T |           |  |
| A T T |       |       | A T T |       | A T T |           |  |
| A A G |       |       | A A G |       | A A G |           |  |
| C T T |       |       | C T T |       | C T T |           |  |
| A T G |       |       | A T G |       | A T G |           |  |
| A A T | A A T | A A T | A A T |       | A A T |           |  |
|       |       |       | C C T | C C T | C C T |           |  |
| C A G |       |       | C A G |       | C A G |           |  |
| C G T |       |       | C G T |       | C G T |           |  |
| T C T | T C T | T C T | T C T | T C T | T C T |           |  |
| A C T |       |       | A C T |       | A C T |           |  |
| G T T |       |       | G T T |       | G T T |           |  |
| T G G |       |       | T G G |       | T G G |           |  |
| T A T | T A T |       | T A T |       | T A T |           |  |
| 50% Y |       |       | 80% P |       |       |           |  |

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A A C C G G T A A G C T T T C G G -5' O\_K3L\_3



1                      10                      20

E       D       E       A       D

5'- CCTGCAAGCG GAAGAC GAAGC GGATT -

Figure 38: Oligo and primer design for V $\alpha$  CDR3 libraries

| 30   |     |      |    |     | 40 | 50  |     |     |    |
|------|-----|------|----|-----|----|-----|-----|-----|----|
| Y    | Y   | C    | Q  | S   |    | D   |     |     |    |
| -ATT | ATT | TGCC | AG | AGC |    | GAC |     |     |    |
|      |     |      |    |     | A  |     | GCT | GCT | -  |
|      |     |      |    |     | C  |     |     |     |    |
|      |     |      |    |     | D  |     | GAT | GAT |    |
|      |     |      |    |     | E  |     | GAG | GAG |    |
|      |     |      |    |     | F  |     | TTT | TTT |    |
|      |     |      |    |     | G  |     | GGT | GGT |    |
|      |     |      |    |     | H  |     | CAT | CAT |    |
|      |     |      |    |     | I  |     | ATT | ATT |    |
|      |     |      |    |     | K  |     | AAG | AAG |    |
|      |     |      |    |     | L  |     | CTT | CTT |    |
|      |     |      |    |     | M  |     | ATG | ATG |    |
|      |     |      |    |     | N  |     | AAT | AAT |    |
|      |     |      |    |     | P  |     | CCT | CCT |    |
|      |     |      |    |     | Q  |     | CAG | CAG |    |
|      |     |      |    |     | R  | CGT | CGT | CGT |    |
|      |     |      |    |     | S  |     | TCT | TCT |    |
|      |     |      |    |     | T  |     | ACT | ACT |    |
|      |     |      |    |     | V  |     | GTT | GTT |    |
|      |     |      |    |     | W  | TGG |     |     |    |
|      |     |      |    |     | Y  | TAT | TAT | TAT |    |
|      |     |      |    |     | 3  | 1   | 18  |     | 18 |
|      |     |      |    |     | 3  | 1   | 18  |     | 18 |
|      |     |      |    |     | 3  | 1   | 18  |     | 18 |

Figure 38: Oligo and primer design for VA CDR3 libraries

|   |      |      |      |      |      |      |      |                    |
|---|------|------|------|------|------|------|------|--------------------|
|   |      |      |      | 60   |      | 70   |      | 80                 |
|   |      |      |      |      |      |      |      | G G G T K L        |
|   |      |      |      |      |      |      |      | GGCGGCGGCACGAAGTTA |
| - | GCT  | gap  | gap  | GCT  | GCT  | GCT  | GCT  |                    |
|   | GAT  | GAT  | GAT  | GAT  | GAT  | GAT  | GAT  |                    |
|   | GAG  | GAG  | GAG  | GAG  | GAG  | GAG  | GAG  |                    |
|   | TTT  | TTT  | TTT  | TTT  | TTT  | TTT  | TTT  |                    |
|   | GGT  | GGT  | GGT  | GGT  | GGT  | GGT  | GGT  |                    |
|   | CAT  | CAT  | CAT  | CAT  | CAT  | CAT  | CAT  |                    |
|   | ATT  | ATT  | ATT  | ATT  | ATT  | ATT  | ATT  |                    |
|   | AAG  | AAG  | AAG  | AAG  | AAG  | AAG  | AAG  |                    |
|   | CTT  | CTT  | CTT  | CTT  | CTT  | CTT  | CTT  |                    |
|   | ATG  | ATG  | ATG  | ATG  | ATG  | ATG  | ATG  |                    |
|   | AATA | AATA | AATA | AATA | AATA | AATA | AATA |                    |
|   | CCT  | CCT  | CCT  | CCT  | CCT  | CCT  | CCT  |                    |
|   | CAG  | CAG  | CAG  | CAG  | CAG  | CAG  | CAG  |                    |
|   | CGT  | CGT  | CGT  | CGT  | CGT  | CGT  | CGT  |                    |
|   | TCT  | TCT  | TCT  | TCT  | TCT  | TCT  | TCT  |                    |
|   | ACT  | ACT  | ACT  | ACT  | ACT  | ACT  | ACT  |                    |
|   | GTT  | GTT  | GTT  | GTT  | GTT  | GTT  | GTT  |                    |
|   |      |      |      |      |      |      | TGG  |                    |
|   | TAT  | TAT  | TAT  | TAT  | TAT  | TAT  | TAT  |                    |
|   | 18   |      |      |      | 19   |      |      | Variability        |
|   | 18   | 18   |      |      | 19   |      |      | 3.32E+05           |
|   | 18   | 18   |      |      | 19   |      |      | 5.98E+06           |
|   | 18   | 18   | 18   |      | 19   |      |      | 1.08E+08           |

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T V L G Q E F  
 ACCGTTCTTGGCCAG **G A A T T C** GAGCC-3'  
 3'-CCGGTCTCTTAAGCTCGG-5'

Figure 39: functional map of expression vector series pBS13

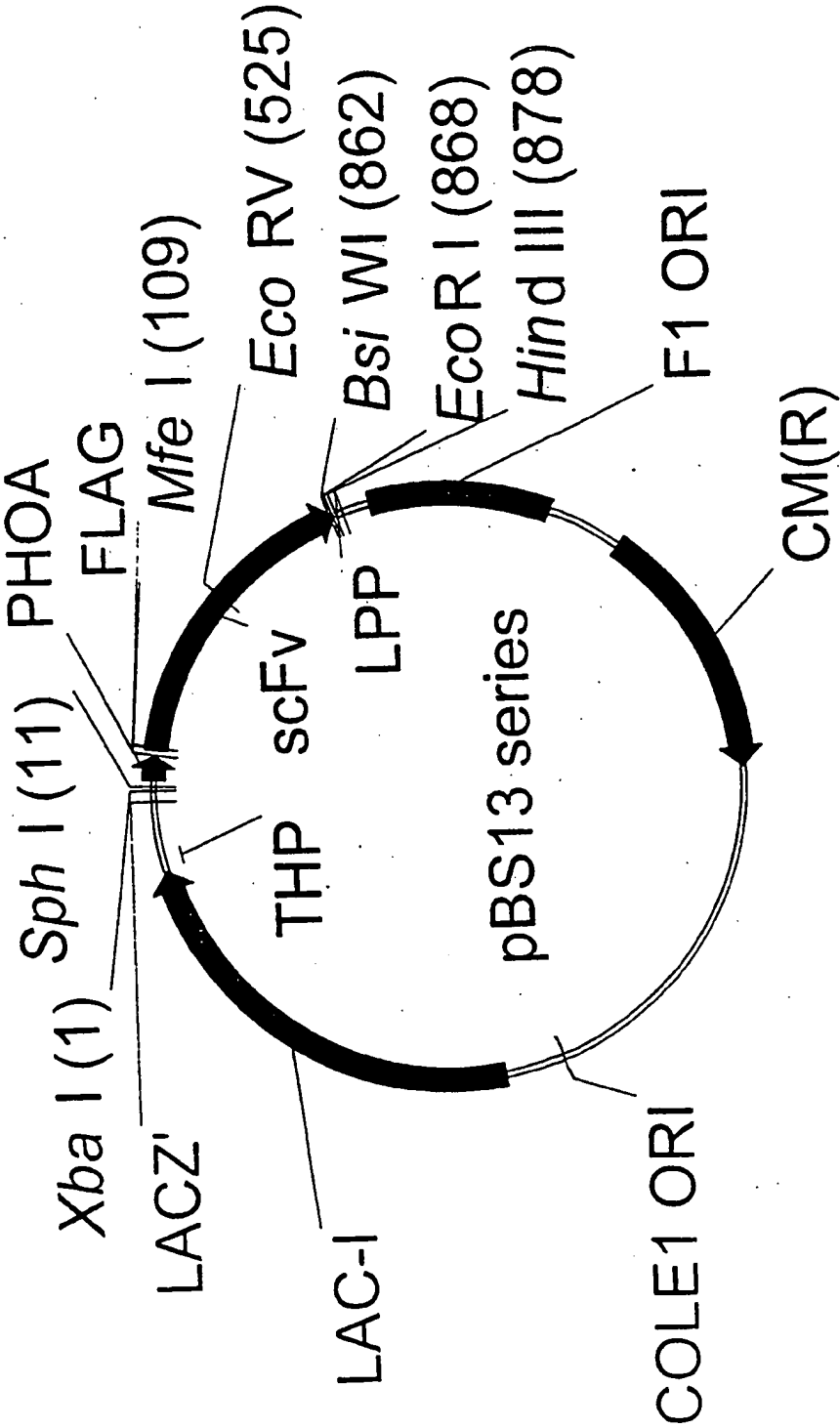


Figure 40: Expression data for HuCAL scFvs (pBS13, 30°C)

| % soluble | $\kappa 1$ | $\kappa 2$ | $\kappa 3$ | $\kappa 4$ | $\lambda 1$ | $\lambda 2$ | $\lambda 3$ |
|-----------|------------|------------|------------|------------|-------------|-------------|-------------|
| H1A       | 61%        | 58%        | 52%        | 42%        | 90%         | 61%         | 60%         |
| H1B       | 39%        | 48%        | 66%        | 48%        | 47%         | 39%         | 36%         |
| H2        | 47%        | 57%        | 46%        | 49%        | 37%         | 36%         | 45%         |
| H3        | 85%        | 67%        | 76%        | 61%        | 80%         | 71%         | 83%         |
| H4        | 69%        | 52%        | 51%        | 44%        | 45%         | 33%         | 42%         |
| H5        | 49%        | 49%        | 46%        | 67%        | 54%         | 46%         | 47%         |
| H6        | 90%        | 58%        | 54%        | 47%        | 45%         | 50%         | 51%         |

| Total amount compared to H3 $\kappa 2$ | $\kappa 1$ | $\kappa 2$ | $\kappa 3$ | $\kappa 4$ | $\lambda 1$ | $\lambda 2$ | $\lambda 3$ |
|----------------------------------------|------------|------------|------------|------------|-------------|-------------|-------------|
| H1A                                    | 289%       | 94%        | 166%       | 272%       | 20%         | 150%        | 78%         |
| H1B                                    | 219%       | 122%       | 89%        | 139%       | 117%        | 158%        | 101%        |
| H2                                     | 186%       | 223%       | 208%       | 182%       | 126%        | 60%         | 97%         |
| H3                                     | 50%        |            | 71%        | 54%        | 59%         | 130%        | 47%         |
| H4                                     | 37%        | 55%        | 60%        | 77%        | 195%        | 107%        | 251%        |
| H5                                     | 98%        | 201%       | 167%       | 83%        | 93%         | 128%        | 115%        |
| H6                                     | 65%        | 117%       | 89%        | 109%       | 299%        | 215%        | 278%        |

Figure 40: Expression data for HuCAL scFvs (pBS13, 30°C)

| Soluble amount<br>compared to H3κ2 | κ1   | κ2   | κ3   | κ4   | λ1   | λ2   | λ3   |
|------------------------------------|------|------|------|------|------|------|------|
| H1A                                | 191% | 88%  | 121% | 122% | 26%  | 211% | 76%  |
| H1B                                | 124% | 95%  | 83%  | 107% | 79%  | 142% | 59%  |
| H2                                 | 126% | 204% | 139% | 130% | 66%  | 50%  | 70%  |
| H3                                 | 63%  | -    | 81%  | 49%  | 69%  | 143% | 61%  |
| H4                                 | 40%  | 47%  | 49%  | 54%  | 95%  | 55%  | 125% |
| H5                                 | 69%  | 158% | 116% | 80%  | 72%  | 84%  | 84%  |
| H6                                 | 85%  | 122% | 87%  | 77%  | 162% | 162% | 212% |
|                                    | McPC |      |      |      |      |      |      |
| soluble                            | 38%  |      |      |      |      |      |      |
| %H3κ2 total                        | 117% |      |      |      |      |      |      |
| %H3κ2 soluble                      | 69%  |      |      |      |      |      |      |